POPULAR SCIENCE

INCLUDING MECHANICS AND HANDICRAFT

APRIL · 35¢ Monthly

X-Ray View of America's Latest Jetliner

TO SEE THE WHOLE PLANE, UNFOLD HERE

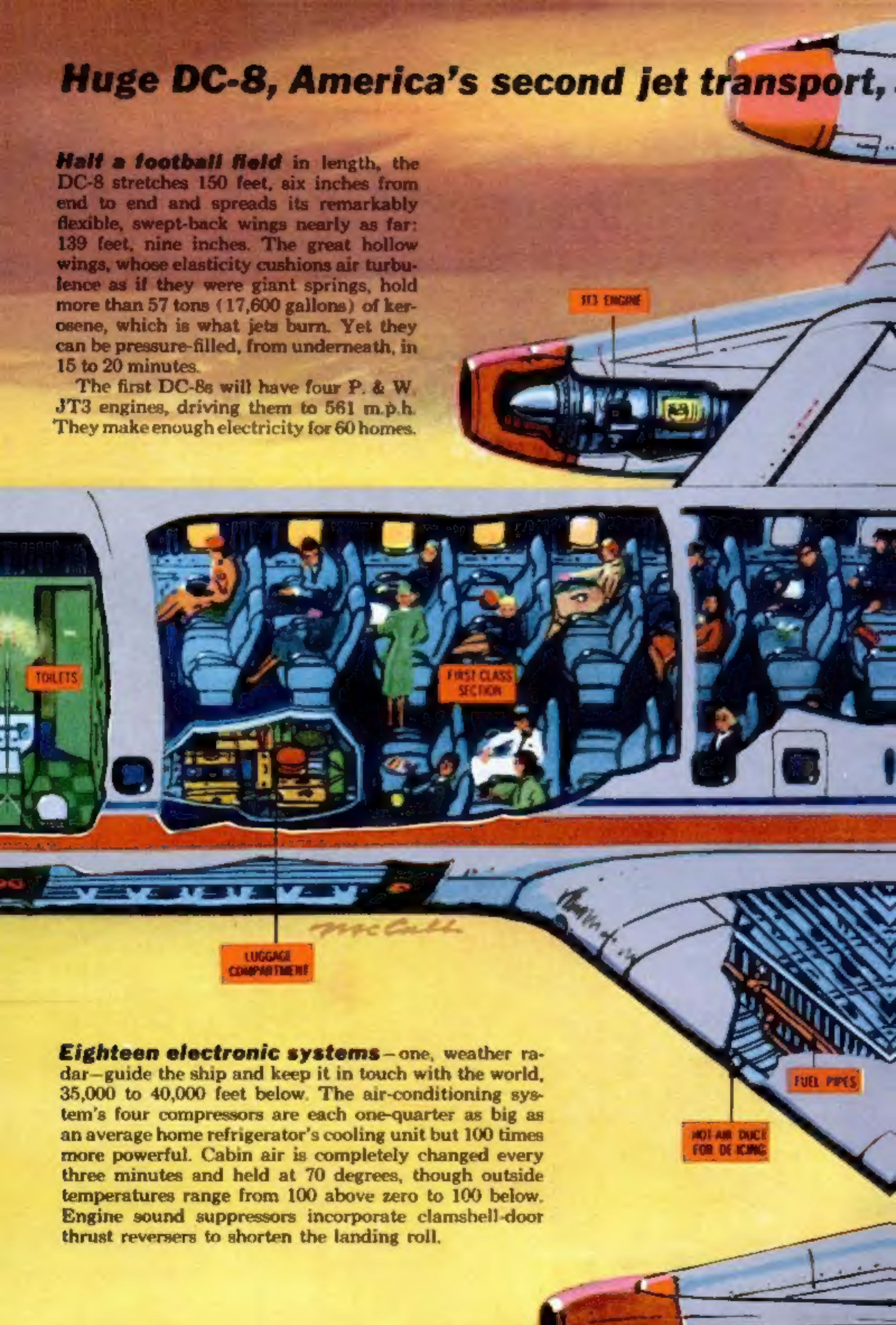
Stupid Traffic Rules Trap Decent Drivers PAGE 142

5 Ways You Can Lick That Tired Feeling PAGE 132

Huge DC-8, America's second jet transport,

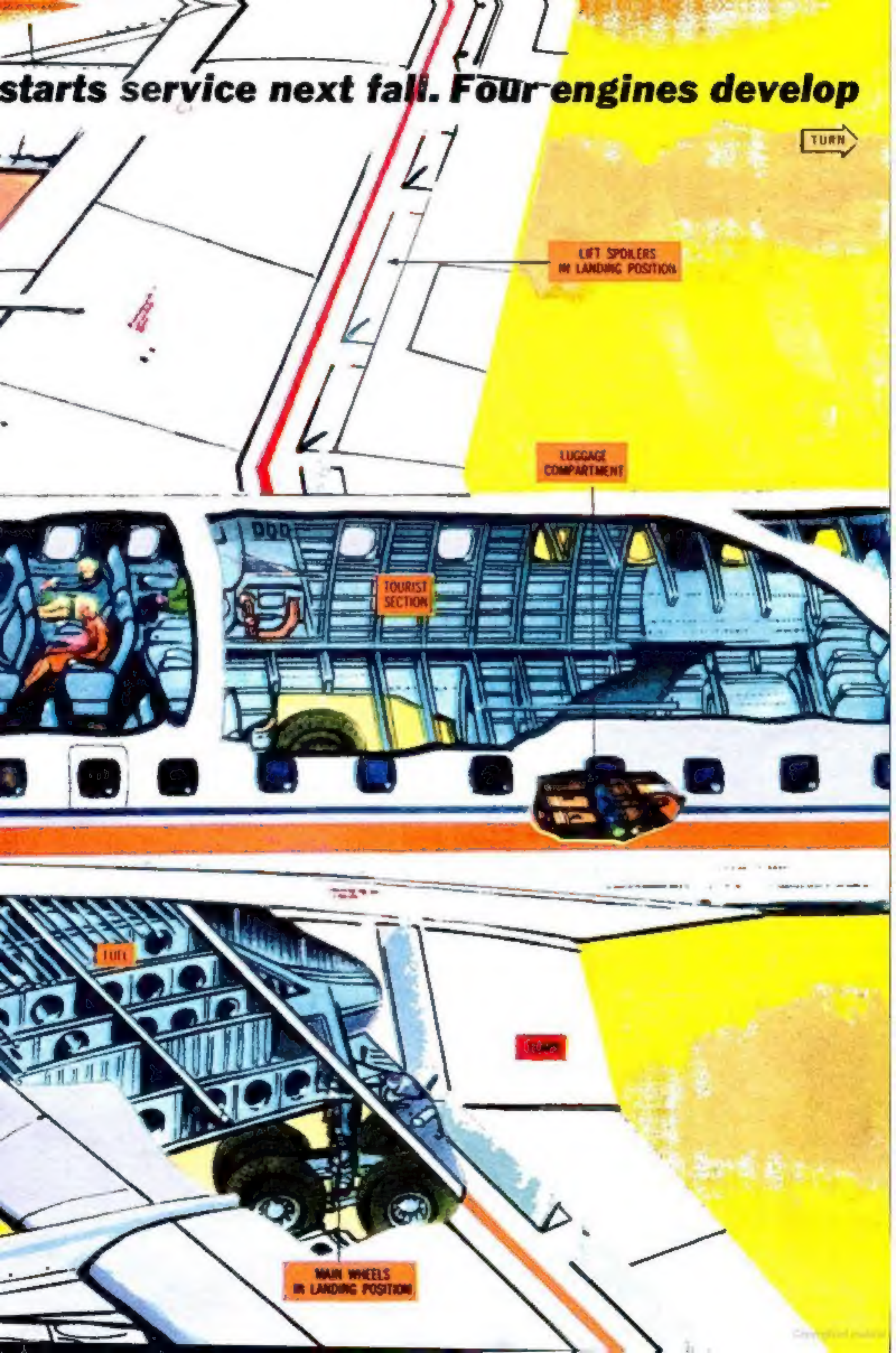
Half a football field in length, the DC-8 stretches 150 feet, six inches from end to end and spreads its remarkably flexible, swept-back wings nearly as far: 139 feet, nine inches. The great hollow wings, whose elasticity cushions air turbulence as if they were giant springs, hold more than 57 tons (17,600 gallons) of kerosene, which is what jets burn. Yet they can be pressure-filled, from underneath, in 15 to 20 minutes.

The first DC-8s will have four P. & W. JT3 engines, driving them to 561 m.p.h. They make enough electricity for 60 homes.

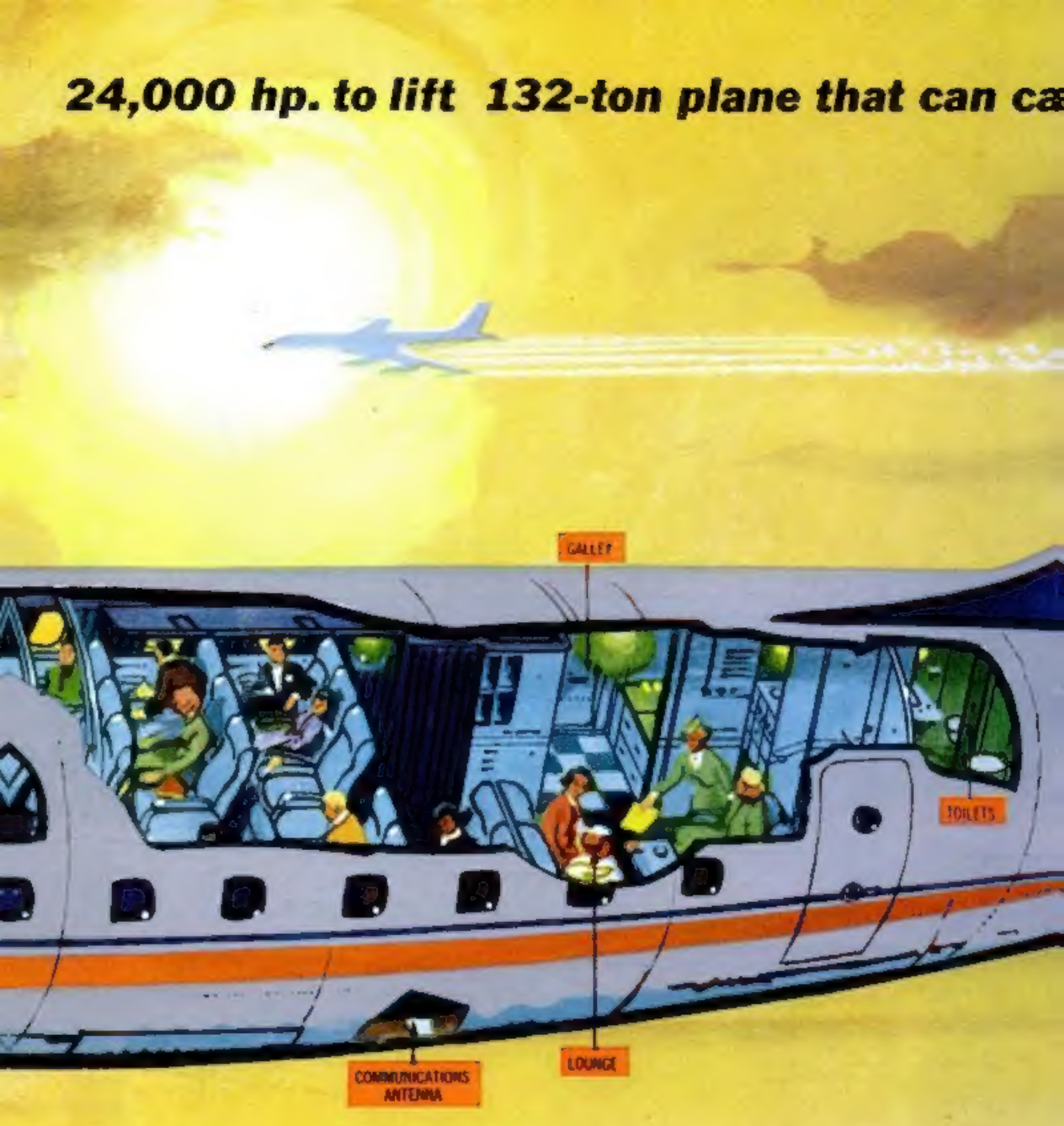


Eighteen electronic systems—one, weather radar—guide the ship and keep it in touch with the world, 35,000 to 40,000 feet below. The air-conditioning system's four compressors are each one-quarter as big as an average home refrigerator's cooling unit but 100 times more powerful. Cabin air is completely changed every three minutes and held at 70 degrees, though outside temperatures range from 100 above zero to 100 below. Engine sound suppressors incorporate clamshell-door thrust reversers to shorten the landing roll.

starts service next fall. Four engines develop



24,000 hp. to lift 132-ton plane that can ca



Chairs and bulkheads are on tracks, making it easy to vary the interior plan several ways, from the 119-passenger, mixed-class arrangement (above) chosen by United Air Lines for the first domestic DC-8 flights, to an all-tourist version seating 176. Each seat has a reading light, cold-air outlet, call button, aisle light, ash-tray, table and emergency oxygen outlet. A hi-fi system carries announcements and music to the quiet cabin, which is pressurized so that a sea-level atmosphere is maintained to 23,000 ft. At 34,000 ft., cabin pressure equals that of 5,000 ft.; at 40,000 ft., that of 6,700 ft. Two large compartments in the plane's belly hold nearly seven tons of luggage and cargo. Compartments are loaded from the starboard side while passengers use two port-side doors.

The plane's soaring tail rises more than 42 feet above the ground. Hot air bled from the engines is circulated through ducts along the leading edges of wings, tail surfaces and engine pylons to prevent icing. Another thermal system keeps engine inlets, air-conditioning scoops and the radome ice-free. Blasts of hot air will clear the electrically heated windshields of rain and snow.

There are four wheels, mounted in tandem pairs, on each leg of the main landing gear. The rear pairs swivel, to make taxiing easier. Main wheels and nose wheels (two) will drop by gravity in case the hydraulic system fails.

The flight crew, with 120 instruments to watch, will contain a navigator only when the DC-8s start making ocean crossings.

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Above: DC-7 gets set for flight from Idlewild to Paris.

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Popular Science

April, 1959

Cover painting by Bob McCall

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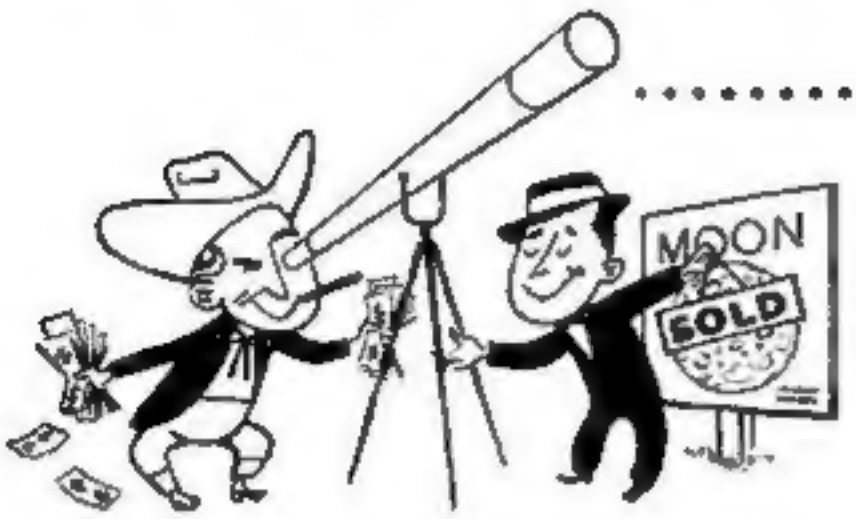
PS Readers

TALK BACK



Covered Wagons to Blast Off?

RECENTLY I got hold of a copy of *Our Public Lands*, a magazine published by the U.S. Bureau of Land Management. I was much amazed to discover in it that for some years our government has been getting letters from citizens intent on staking out claims in space.

One hopeful applying for 160 acres on the Moon says he prefers "the shores of waterless Mare Crisium—eventually it may be made into a nice artificial lake." Another, anxious to pioneer on Mars, wants grazing rights to five sections of land. There's also a wistful character interested in Moon acres. He asks: "Any taxes?"

JOSEPH HANSCOM, NYC.

The Bureau of Land Management has a form letter, headed "About Land on the Moon or Planets," with which it replies to such requests. It says, in part: "It is not possible for anyone to make application for or obtain rights to land on the Moon or planets through the United States Government. This country has as yet made no claim to any territory beyond the Earth. There are no provisions of National Law covering the acquisition of private rights in Outer Space."

Problem of Brake Fade

I'VE just read "The Baffling Problem of Brake Fade," [Jan.] in my newly-subscribed-for POPULAR SCIENCE. I think the presentation was clear, objective and devoid of eyewash. This is the type of reporting that appeals to me as an engineer because it puts our problems before the layman in terms he can understand.

F. R. L. DALEY, Staff Engineer
Buick Motor Division, Flint, Mich.

. . . While reading about brake fade, I wondered if anyone has considered a combination of metallic brake lining for one half of the brake and organic fiber for the other half.

I remember once coming down the dangerous descent of Palomar Mountain (Cal.) when the temperature was very high. We ended up with nothing working but the low gear—and that was about ruined. The same thing happened coming down Gibraltar Pass near Santa Barbara.

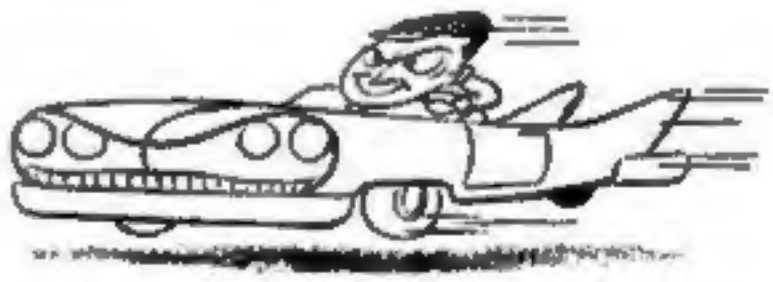
If a suitable combination could be made, people who drive between excesses of temperature could be safer. Perhaps one type could be used in front, the other in the rear. Has this been tried?

RALPH MORSE, Berwick, Me.

Almost every conceivable combination of metallic and organic linings has been tried or is being tried now by brake engineers. They have even gone so far as to alternate metal and fiber pads on the same shoe. As yet, no combination is ready for release to the public.

Woes Vs. Blessings

I AGREE with Paul W. Kearney ["A Safety Expert Looks at the '59 Cars," Jan.]. A working model of a guillotine in the hands of children is no more danger-



ous than a car—as made and operated today.

This leads me to a solution for the problem of population control: Since it has become a challenge to break the death record of each previous holiday, why not establish a few more holidays? Guaranteed to work or your life refunded!

E. R. HOLTZ, Hastings, Pa.

. . . See here, Kearney! If your blast at U.S. cars is so right, it's too bad you

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"I SAW MYSELF 10 YEARS FROM NOW!"

It happened one payday . . .

Fred worked on the line next to me. Nice guy. Married. Two children. Been on the same job 10 years.

As we walked away from the pay window together he said, "Funny. Each week I get to feel like I'm letting my family down. You know. Not getting ahead so I can give them the things they need."

His words hit me all of a sudden. I could see myself saying the same thing—*10 years from now!*

Not only that. I could see the same job. Same thin paycheck. Same worries.

I thought about Fred all day. Then that night I saw an ad for I.C.S. It told about the job opportunities that open up with I.C.S. training. How people had found new careers and job success.

I mailed the coupon and that was the start. In just a few months my boss discovered I was an I.C.S. student. He was so pleased he decided to move me off the line. A year and two raises later I was made an assistant supervisor.

What about Fred? He's still working on the line. Still hoping for the future.

I told him about I.C.S. But so far he hasn't done anything. I guess some people never will.

How about you?

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didn't get it in last year when it would have been more appropriate.

Specifically, what's this bit about rollovers? According to your figures, the Detroit boys are a bunch of blockheads. You give no credit to those few who stretched the width of the Pontiac. You get yourself a '59 Pontiac, take it to the Cornell group that's studying wrecks and let them *try* to flip it!

J. H. ANDERSON, San Francisco.

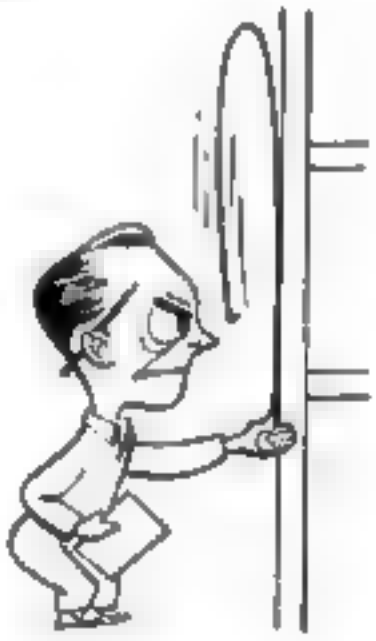
. . . Praises to Kearney! Let's face it —Detroit hears only the quiet crunching of the folding buck. The crunching of cars lacking safety features goes unheard.

Car makers spend considerable time and money for some character to decide whether the fins go up or down—he's making a fish—and if safety spoils the dream, forget it. Many a teen-ager with a few dollars, a little time and some hand tools takes a relic and comes up with something that looks better, probably is faster and certainly is safer than any new stock car.

Until the car builders come up with a safety package at a reasonable price (less the fishmaker's salary), I refuse to buy.

D. L. COCHRANE, Cambridge, Minn.

He's Flexible on Rules

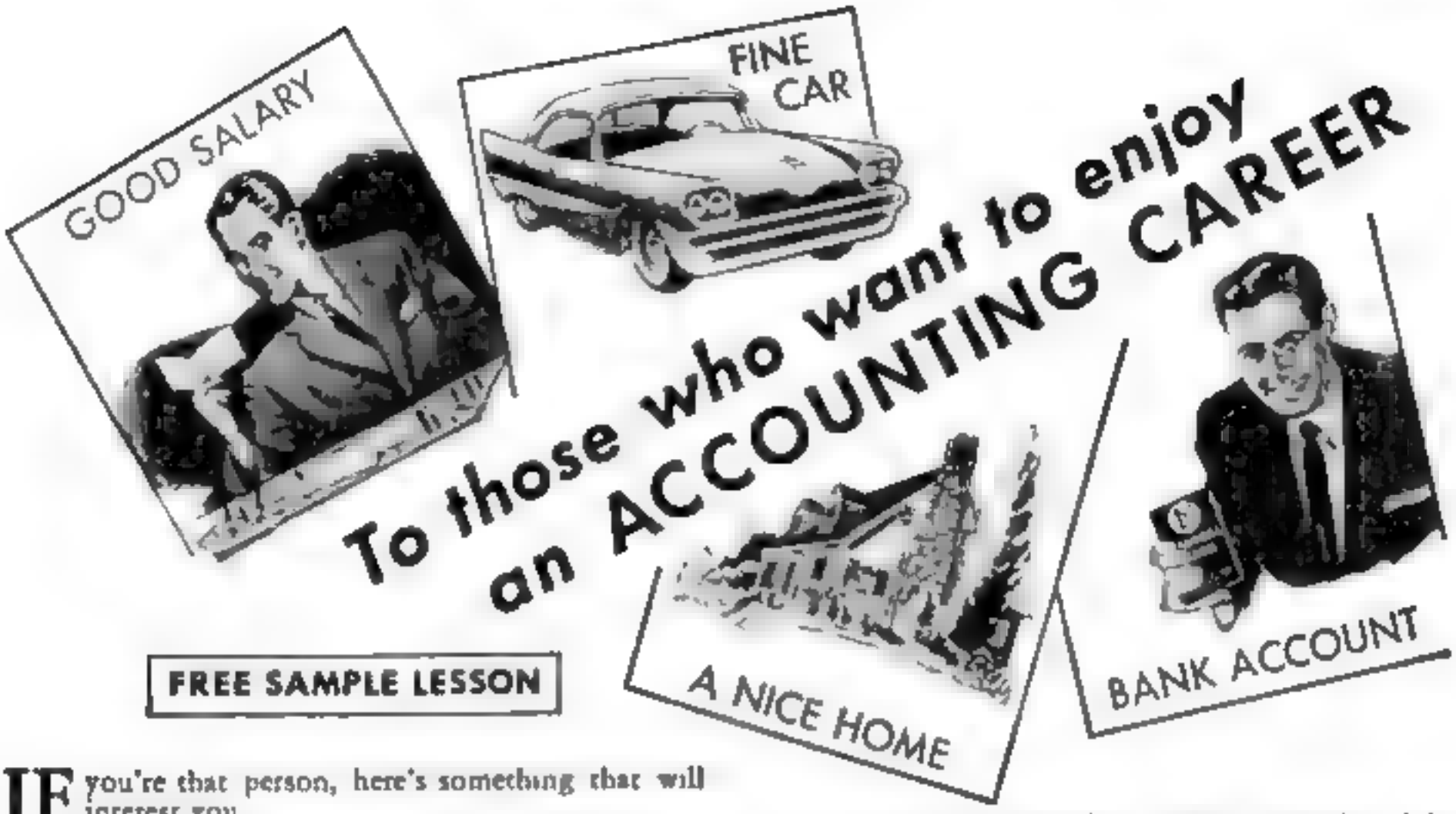


THE rule wanted by the author of "Choosing a Flexible Rule" [Jan.] would be nice. I, too, would like a 16-footer that extends up eight feet without bending and carries markings for both running inches and feet and inches. But frankly, I'll settle for one that can be carried daily in my business suit without too much bulk.

JACK HANLON, Rochester, N.Y.

Checking for a Hot Wire

MAY I add a warning on using a neon test light to distinguish the hot from the neutral wire ["Short Cuts and Tips," Dec.]? For safety, anyone following this procedure should be aware that the test isn't absolutely conclusive. There may be cases, as I've found in my house, where



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the metal box or cable sheath is not necessarily in contact with the ground. In such instances the light won't glow, thus giving a false reading.

J. J. ANTHONY, Melrose, Mass.

Is Mixing Fair?

YOUR tradition-block problem ["Boosting Your Output of Good Ideas," Jan.] has at least one other solution. To measure out a quart of water, working with a six-quart bucket of water, a two-quart bucket of gasoline and an empty three-quart bucket:

Pour the two quarts of gas into the empty three-quart bucket. Pour water from the six-quart bucket into the two-quart bucket. Pour off from the two-quart bucket enough water to fill the three-quart one. Result: One quart of water remains in the two-quart bucket.

DAVID GOMBERG, Chicago.

. . . That tradition-block problem is loaded with a "false-requirement" block, too. Nowhere does it state that the water and gasoline must not be mixed, leaving a far easier solution possible than the one you give.

J. R. CLAGHORN, Neenah, Wis.

. . . Why not 1) pour the gasoline in the two-quart bucket into the empty three-quart bucket; 2) fill the three-quart bucket with a quart of water from the six-quart bucket; 3) wait a few minutes for the two liquids in the three-quart bucket to separate, then decant the upper layer of gasoline into the two-quart bucket.

If the remaining quart of water is to be used for drinking purposes, add two parts bourbon and a little ice.

DICK GUERNSEY, Chicago.

Just Generous

THE statistician who handled your car survey ["What *You* Think of the '59s," Jan.] was a lulu. Under predictions of car sales, the report says 47 percent of

How I retired in 15 years with $300 a month

"Here's one Yankee who's fallen in love with the South! When I retired, I moved to the Florida West Coast. I go fishing in the inlets. It's a tropical paradise, yet it's near enough to drive into Tampa often. I'm beginning a new life—all because of the check for $300 I get each month.

"My retiring came out of a business trip to Tampa in 1944. I was dining at a restaurant and happened to notice Don Nelson, a friend of mine from New York. I went over to wish him a wonderful vacation.

"'Vacation? Why, didn't you know we moved down here when I retired?'

"I was amazed. 'But you're too young to be retired!'

"'Nonsense!' he smiled. 'It's what I'd been planning for fifteen years.'

"Don invited me out to his home the next day. 'I sure envy you,' I said. 'I know I never could save enough money.' Then Don explained that he never could have retired on what investments or savings he had. But he had a good salary and he had found a way to make part of his salary buy a retirement income. It was called the Phoenix Mutual Retirement Income Plan.

"Flying home, I noticed a Phoenix Mutual ad in a magazine. Sure enough, I could get a retirement income guaranteed for life if I started young enough. When I got home, I cut out the coupon and sent for the booklet telling all about Phoenix Mutual Plans. In a few days it came by mail. And there was exactly the plan for me. If I started right then—at 40—I'd be able to retire in only fifteen years with $300 a month.

"I felt more and more pleased and secure as those fifteen years went by. I decided on the West Coast of Florida because I had old friends in that area. And as soon as my first check for $300 arrived, I was off. Now that I'm settled, the real fun's just beginning."

Send for Free Booklet

This story is typical. Assuming you start at a young enough age, you can plan to have an income of $20 a month to $3,600 a year or more—beginning at age 55, 60, 65 or older. Send the coupon and receive, by mail and without charge, a booklet which tells about the Phoenix Mutual Plans. Similar plans are available for women. Don't delay. Send for your copy now.

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Date of Birth_____

Business Address_____

Home Address_____

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by Practicing at Home in Your Spare Time

N.R.I. gives you equipment like this. You learn by doing—get practical experience.

Fast Growing Field Offers Good Pay—Bright Future

Bigger than ever and still growing. That's why Radio-TV Electronics has special appeal. The technical man is looked up to. He does important work, gets good pay. Keep your job while training. You learn at home in your spare time. NRI methods have proved successful for 45 years; can provide training quickly.

Add to Your Income Soon $10-$15 a Week Extra in Spare Time

"I was repairing Radios by 10th Lesson. Now have good TV job." *M. R. Lindemuth, Fort Wayne, Ind.*

Soon after enrolling, many NRI students earn $10-$15 a week extra fixing sets. Equipment NRI gives you *brings to life* things you study.

"Doing spare time repairs on Radio and TV. Going into full time servicing soon." *Clyde Higgins, Waltham, Mass.*

Find Out What NRI Offers

NRI is the OLDEST, LARGEST home study Radio-TV school. Mail coupon below for Lesson and 64 pg. catalog. National Radio Institute, Dept. 9DB, Washington 16, D. C.

"I had a successful Radio repair shop. Now I'm Engineer for WHFE." *V. W. Workman, High Point, N. C.*

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Dept. 9DB, Washington 16, D. C.

Please send me Sample Lesson of your Radio-TV Electronic Training and Catalog FREE. (No salesmen will call.)

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Address_____

City_____ Zone___State_____

Accredited Member National Home Study Council

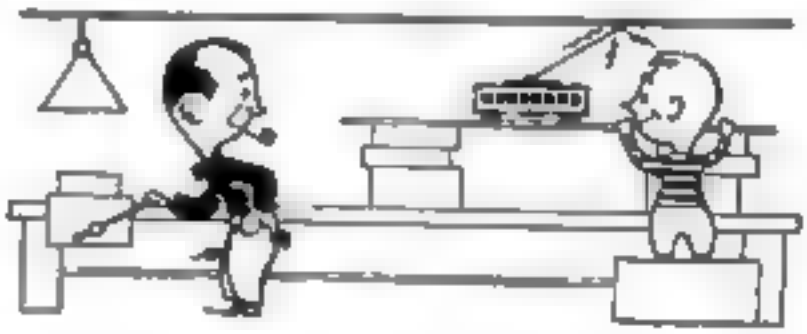
the people polled said "Better than last year," 36 percent said "Same as last year," and 18 percent said "Worse." Add this all up and it comes to 101 percent. Ah well, maybe they'll turn out to be 101 percent wrong.

J. N. BIERMAN, St. Louis.

This is a common statistical mishap that occurs when the decimals on such figures as 46.6, 35.7 and 17.7 are rounded out

Better Shop Light

YOUR sliding shop light ["Wordless Workshop," Jan.] is good—but dangerous. I have accomplished the same results using a 10-foot length of Bulldog



50-amp trolley duct with a fixture suspended from a trolley. It is simple to install, approved, and possibly less expensive

R. BERLING, New Monmouth, N.J.

Sound and Hot Air

How come sound travels faster in warm air than in cold air? Since cold air is denser than warm air, this would seem to contradict the fact that sound travels fastest in dense materials.

JAMES LEGLER, W. Hartford, Conn.

Two factors determine the speed of sound in a material: density and elasticity. Greater density slows sound down (the reverse of your notion); higher elasticity speeds it up. Thus, sound will travel faster in warmer (thinner) air. And thus too, although a solid such as iron is denser than gas, its elasticity is enormously greater and sound will travel faster in it.

The Short and the Long of It

IN THE article "How Nautilus Hit the Bull's Eye" [Jan.], you say sidereal, or star, time is more exact than sun time, "though each day is four minutes longer."

This should read "each day is four minutes shorter." A sidereal day is 23

New 4-in-1 Storm Kit Protects You Head to Foot in Rain & Sudden Shower!

HANDSOME, TAILORED RAIN COAT OF GENUINE VINYLFILM BY

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Here's the bargain of the year! World-famous GOODYEAR quality, plus smart BAROMETER tailoring—at a sensational low price that will take your breath away. This fine raincoat will give you years and years of service—same water-repellent protection as coats costing $10.95—yet you pay only $6.98! And that's only the beginning! You also receive 3 gifts FREE! 1) Pair of sturdy, long-lasting GOODYEAR Pliovic Rubbers—$2.98 value—yours FREE! 2) Well designed adaptable Hat Cover for straw or felt hats—$1.00 value—yours FREE! 3) Water-proof Carrying Case—light, flexible, handsome—$2.00 value—yours FREE. Yes, you pay only $6.98 for your raincoat and you receive $5.98 worth of FREE gifts! In essence, the raincoat costs you only $1. But you must act fast! This is a special advertising offer to readers of POPULAR SCIENCE—and it's for a limited time only! We can guarantee this amazing bargain only while supply lasts! Rush coupon below for your 3 FREE GIFTS plus 10-day FREE Trial!

Get complete head to foot protection in rain, sudden shower, storm! Remember the entire outfit weighs only ounces and folds into the compact case. Fits easily into brief case or fold and fit into jacket or pocket. You have fingertip protection in case of sudden showers or rain!

Raincoat in Textured GABARDINE Finish with Electronic Welded Seams for Longer Wear!

You'll like this Barometer Tailored Raincoat at first sight. So handsome in textured GABARDINE finish! Latest gun-metal color for men of action! Big, luxurious built-in pockets . . . tailored fly front . . . vented underarms for even greater comfort. Latest patented electronic lap welding process—seams just CANNOT RIP APART in normal wear! This quality garment outlasts old style butted seam raincoats—yet costs no more. Please do not confuse with inferior, transparent polyethylene raincoats that may rip, tear after a few wearings in the rain. This Barometer-tailored, Goodyear vinylfilm will give you YEARS and YEARS of service!

Raincoat Remains Waterproof and Never Needs Dry Cleaning!

If you've ever bought the regular tan colored poplin-type raincoat you know that it dirties fast—needs constant dry cleaning—and CAN LOSE ITS WATER REPELLENCY feature! Your handsome Barometer Raincoat NEVER NEEDS DRY CLEANING—wipes clean with a damp cloth—REMAINS WATERPROOF FOREVER! You SAVE many, many dollars on dry cleaning bills alone—and you always know that water CAN'T SEEP THRU!

WEAR IT TEN DAYS FREE!

Frankly, you've got to see this smart new raincoat to really appreciate its true value. That's why we ask you to enjoy FREE 10-day home examination of the complete 4-in-1 Storm Kit . . . raincoat, rubbers, hat cover and carrying case. You must be satisfied in every way or your $6.98 comes back to you. But you must order your Raincoat now. This special offer may be withdrawn without notice due to our limited supply. Mail the FREE-Trial, FREE-GIFT coupon below direct to the bargain house of FIVE MILLION satisfied customers! Check box for desired size, Small, Medium, Large and Extra-Large.

ALL 3 FREE!

Free!

1 Rubbers of Tough, Durable

GOODYEAR PLIOVIC

2.98 VALUE

Pebble finish rubbers . . . positive footing on wet, slippery surfaces! Attractively styled and lightweight—yet sturdy and they s-t-r-e-t-c-h! They stretch over shoes for snug, ultra-comfortable fit. Price separately: $2.98. Yours FREE with Raincoat!

This offer available only mail only from Thoresen's, Dept. 7-D-38, 585 Water St., N. Y. 2, N. Y.

Free!

2

HAT COVER

1.00 VALUE

Sturdy, durable. Won't crack, peel or stain. Electronically sealed. Neat appearance. Keeps hat dry, clean, well shaped.

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3

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585 Water Street, New York 2, N. Y.

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Check Size Raincoat Desired:

☐ Small ☐ Medium ☐ Large ☐ Extra-Large

☐ Check, cash or money order enclosed. Send postage paid

☐ Send COD plus COD fee and postage costs. (ENCLOSE $1 deposit now.)

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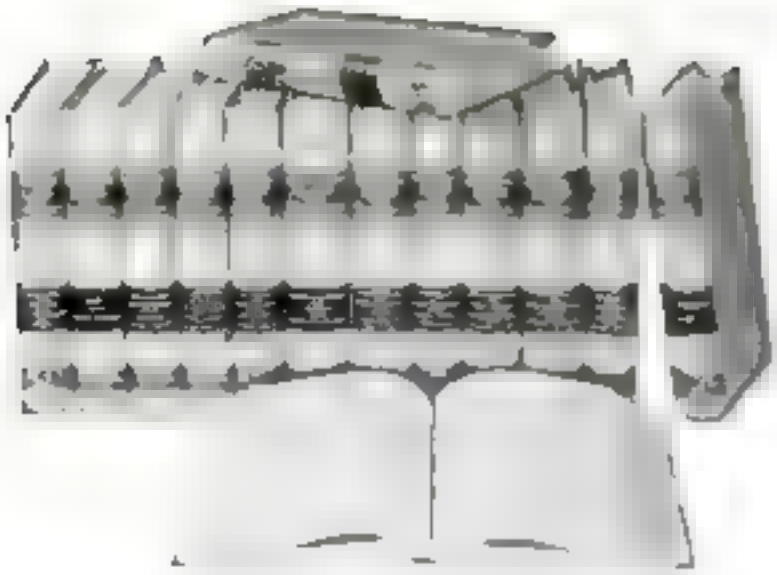

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City ..... *Zone* ..... *State* .....

hours, 56 minutes, 4.091 seconds of mean time. Thus, there are 366.24 sidereal days in a mean solar year of 365.24 days.

LESTER BARSTOW JR., Melville, N.Y.

Right.

Gus on the Firing Line

DISCUSSING a V-8 ["Gus Rescues a Rookie," Jan.] Gus says: "Your firing order is 1-5-4-8-6-3-7-2, starting with the front right as 1, and going 1-2-3-4 on the right. 5-6-7-8 are on the left bank, again starting at the front."

Shouldn't this read 1-3-5-7, starting with right front; and 2-4-6-8, starting with left front bank?

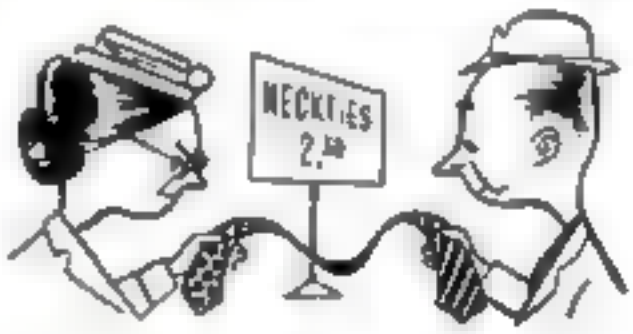
JOE SCHIAO, Pueblo, Colo.

Rookie Newman drove a Ford. Most other cars use the system you describe.

Wanted: Twice as Many Eyes

I'VE seen a number of amazing statements in "New Ideas from the Inventors," but the one relating to reversible neckties [Jan.] takes the prize.

The writer says that by lining the wide end with a different design you'd get "twice as many changes with half as many ties." Twice as many changes with the same number of ties I can see, or the same number of changes with half as



many ties I can understand. But twice as many changes with half as many ties —that, someone will have to explain!

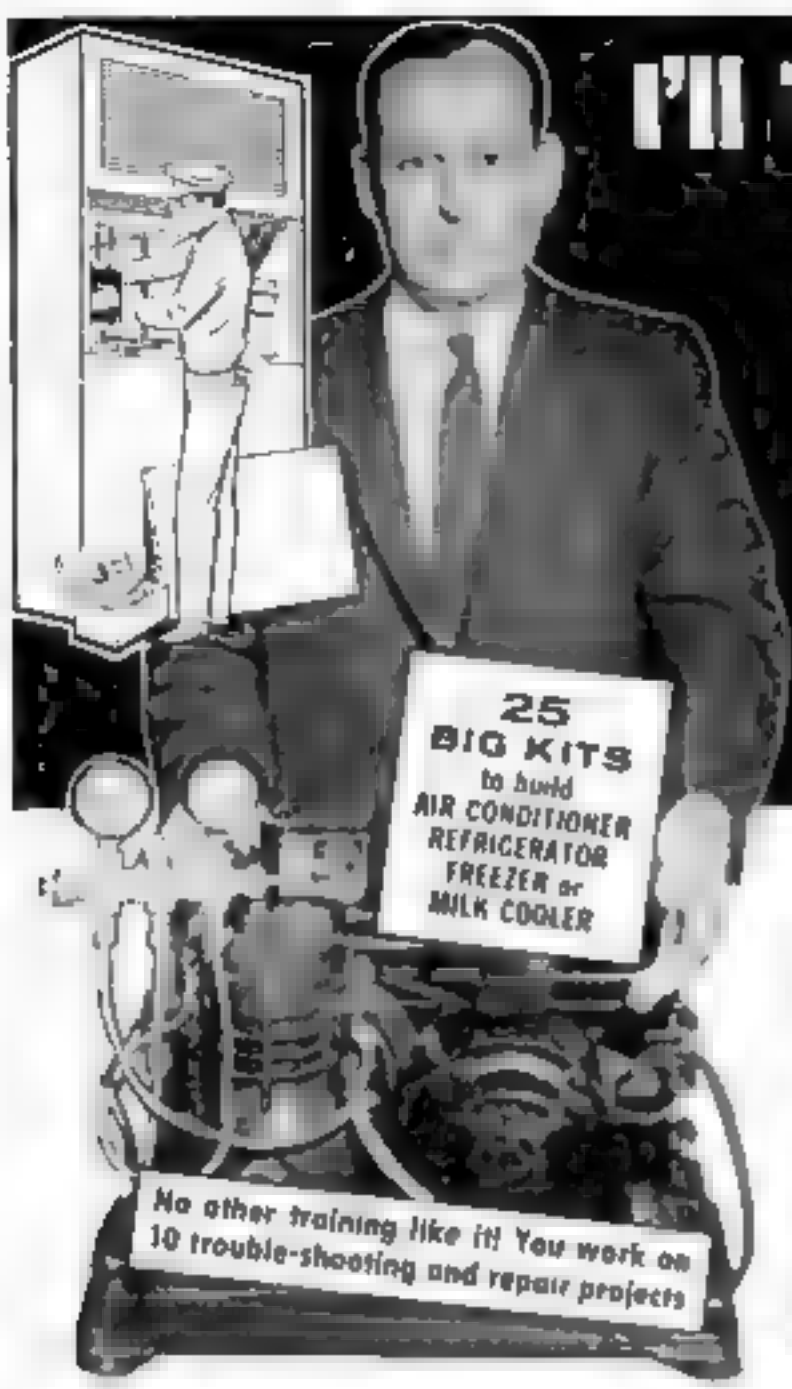
C. L. SKINNER, Madison, Wis.

Why Proofreaders Turn Gray

WHAT happened to the tread width of the Pontiac ["Pontiac Goes Classy," Nov. '58] after your magazine went to press? You say the width of the front tread is just short of five feet—or less than 60 inches. But the owner's manual lists a front tread width of 63⅝ inches, rear tread width of 64 inches.

GEO. SHELDON, Greenville, Mich.

The author says, ruefully, "Mr. Sheldon is absolutely right."



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—R. C. Andersen, President of CTI

Only CTI sends you 25 training kits! At no extra cost, you get all parts and tools to assemble a heavy-duty, commercial-type, ¼ h.p. high-side (illustrated above). You work on 25 shop-type programs, do 10 trouble-shooting and repair projects—all in your own home!

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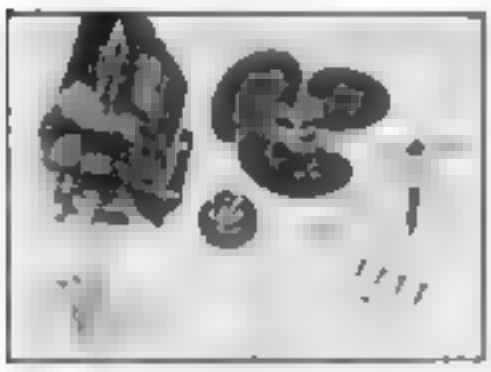
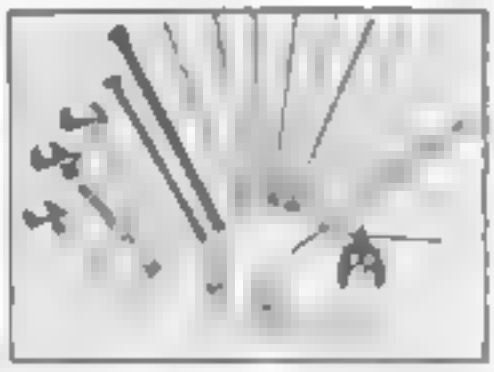
You've read about the amazing growth of the air conditioning and refrigeration industry. It's one of America's largest opportunity fields because over 150 million units are in use. Last year, 3 million refrigerators, 2 million air conditioners and a million freezers were sold. All this adds up to a big demand for trained technicians who can install, repair and service. They make good money, work steady, enjoy security. Many open their own shops—become independent.

You can get ready for one of the top-pay jobs in just a few months. CTI will train you at home in spare time. You'll train with real kits, get practical experience as you go along. Be sure to mail coupon below for the full story on how you can succeed in this old, established, but growing industry!





Many Students Earn Extra Money as They Train

Many students soon after they start training, do repairing in spare time. They work with local dealers evenings and week-ends. Others go "on their own." They earn extra cash, get added experience. Some land full time jobs while students, and quite a number open shops. All this is possible because CTI training is so practical.

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You *practice* as you *train*, thanks to CTI Shop-Method Home Training. CTI trains you in months, not years—eliminates a long period of low-pay apprenticeship. At left are photos of but two of the 25 big kits you get—along with easy-to-understand, illustrated lessons.

YOUR BIG OPPORTUNITY TO OPEN A SHOP!

Students often build up a list of customers which includes not just homes, but office buildings, shops, food stores and industrial plants. They contract to do servicing on a fee basis, or simply answer calls. The Air Conditioning and Refrigeration field offers plenty of opportunity for independence. Own a shop—Be the boss! Mail coupon today!

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The Air Conditioning and Refrigeration industry is growing so rapidly that *20,000 newly-trained mechanics are needed each year.* You owe it to yourself to investigate your opportunities. You can have all the facts—FREE—by just filling out and mailing coupon. But be sure to act today!

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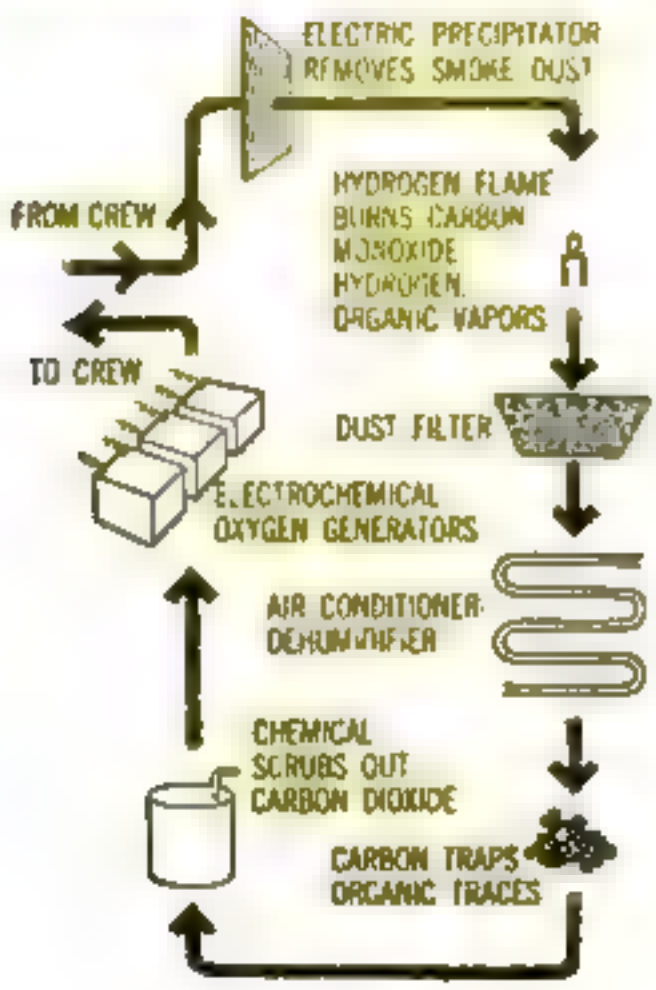
The month in science

Spaceship under the sea. Atomic submarines are already showing how space pioneers will keep alive and happy on long, hazardous voyages. Like a spaceship, an atom sub seals its crew away from the atmosphere for long periods (60 days is the record). The men have to breathe, and they insist on smoking, too. The Navy has just divulged the ingenious systems that make this possible.

Oxygen is only one problem, but a big one. The sub's 100-man crew burns up 100 cubic feet an hour! Tanks of compressed oxygen replenish the submarine airspace now, but they are clumsy. So the Naval Research Laboratory is trying trickier methods:

- Oxygen candles. A mixture of sodium chlorate and finely divided iron powder, they burn like ordinary candles but give off oxygen.

How A-Sub Crews Will Get Air to Breathe



- Batteries. Regular nickel-cadmium storage batteries can be rigged so that they give off oxygen when they are charging and hydrogen when discharging. (The hydrogen comes in handy, too—see below.)
- Absorption tanks. Electricity (there's plenty from the atom engine) decomposes a sodium sulfate solution. Out come hydrogen, oxygen, sodium hydroxide and sulfuric acid. The sodium hydroxide absorbs carbon dioxide from the air (the crew exhales 100 cubic feet of that every hour, and it has to be gotten rid of somehow). This reaction forms sodium carbonate, which is next mixed with the acid. That gives back the sodium sulfate you started with, plus pure carbon dioxide gas, which can now be dumped into the sea.
- Algae. These microscopic green plants, which grow in ponds, take in carbon dioxide, use it to make sugar, and give off oxygen that's left over. This solves both oxygen and carbon dioxide problems, and, if they can ever develop algae that taste good, might feed the crew, too.

Eliminating possible poisons from the air is even tougher. Besides carbon dioxide, the only one present in quantity is water vapor, which the air conditioners squeeze out. But then there are smaller yet troublesome amounts of:

- Carbon monoxide (from all those cigarettes and pipes). This is burned to dioxide by blowing the air over a hot catalyst in a hydrogen flame (that eliminates the hydrogen, too).
- Organic compounds. Even the slow evaporation of thinner from the painted walls builds up. A switch to water-base paint would

EARN WHILE YOU LEARN

NOTHING ELSE LIKE IT!

See How DeVry Tech Prepares You for a Good-Paying Career in

TELEVISION RADIO ELECTRONICS

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NOW you may build and keep your own top quality High Fidelity 6-Speaker Stereophonic Sound System as shown below. You Learn-By-Doing for a BETTER JOB or to ADD TO YOUR PRESENT INCOME. As a bonus, you and your family can enjoy the thrills of this marvelous sound system for years to come.

Special SHORT COURSE in High Fidelity Sound Reproduction, including Stereophonic Systems also available. Ideal for hobbyists, music lovers and men seeking NEW OPPORTUNITY. Mail coupon.

GET A BETTER JOB OR BE BOSS OF YOUR OWN BUSINESS

NO ADVANCED EDUCATION OR PREVIOUS TECHNICAL EXPERIENCE NEEDED!

At home in your spare time, you use the same basic method followed by students in our Chicago and Toronto laboratories. You learn to use tools, follow diagrams, when you build any or all of this valuable equipment: the STEREO SYSTEM . . . or a 5-INCH OSCILLOSCOPE and VACUUM TUBE VOLTMETER . . . or a 21-inch TV SET. You have many choices! DeVry Tech's program is so thorough that you will likely be surprised at your progress. Send the coupon for details.

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Frequently we simply don't have enough graduates available to fill all the jobs on our list! DeVry Tech has an Employment Service that really works. It is available to graduates without additional cost.

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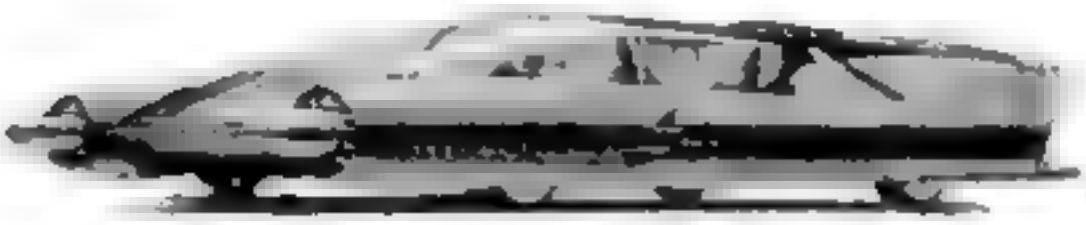
ONE OF THE BIGGEST OPPORTUNITY FIELDS OF THE CENTURY!

fix that, but there are many other hydrocarbons (mostly unidentified) in the air that have to be burned or filtered out.

- Aerosols. These are fine particles suspended in air—three-fourths of them tobacco smoke. Subs now carry electrostatic precipitators (similar to electronic filters in some home air conditioners) in their galley stove exhausts, but bigger ones will be needed.

New cars—1980 models. Plymouth chief engineer Jack E. Charipar tuned up his time machine recently for a sharp look at the automobile of the future. The picture he got was a big, slick and fast dream wagon:

- Very high speeds, made possible by superhighways and automatic driving controls. This calls for true streamlining with big fins for stability. Windows will be flush and fixed—perhaps covering the entire top of the car with "transparent steel."



- Only two basic bodies—sedan and station wagon. Still, all kinds of options will let you order anything from two-door utility carriers to a "magnificent suburban land yacht."
- Hotter engines, but smaller and lighter (less than 800 pounds). They'll be mounted forward because only one chassis design will be used, and that must suit wagons and sedans both.
- Slightly lower bodies—down to around 51 inches, which is the limit unless passengers lie prone—but not much change in length or width. The hood and deck may drop below the wheels, leaving fender "blisters" sticking up like the ones on the salt flats speed-record cars. This will cut road clearance to four or five inches, so low that utility vehicles will need adjustable suspensions to increase clearance for rough going.
- Wraparound sheet metal—with color fused into it instead of sprayed on—even enclosing the underside.
- No gas tank. Instead, plastic fuel containers will be tucked away in odd nooks and crannies (quarter panels or front fenders).
- Brakes mounted away from the wheels for better cooling. Even so, they'll need an assist on high-speed stops from aerodynamic flaps that open out of the fender fins.

One thing Charipar doesn't expect to change is the need for change (to sell cars). He counts on a complete redesign every two years—a cycle made economical by a machine that automatically builds dies directly from drawings. Such a fantastic robot is even now not very far from reality.

Bald birds. There's a glimmer of hope for vain men-over-25. Scientists have at last found a guinea pig for lab experiments on baldness. It's the wattled starling (adult male, naturally), an African bird that loses feathers from the top of its head—permanently—the way men lose their hair. That's all the good news though, men. So far, the cause and cure of baldness are as elusive as ever.

Firestone tire stability on proving ground turning pads wins car makers' top approval.

Firestone Rubber-X* surpasses car makers' toughest tests

Firestone tires give you the turn control, skid-safety and stability you need for today's driving.

to prove Firestone brings you extra safety in tires!

Proof of performance makes Firestone tires number one choice of car manufacturers. Again for '59, more cars will roll off assembly lines on Firestone tires than on any other make. On the proving grounds of the world's most competitive industry, nothing about tires is left to chance. Hard-to-convince engineers cramp screaming wheels into tight maneuvers on special turning pads. They measure noise, skid-safety, cornering stability and ease of control. They race test tires to the limit over everything from high-speed tracks to broken pavements.

From carefully controlled brand-for-brand tests like these, automotive engineers see which tires perform best. Again this year, auto industry testing has made Firestones first choice tires for original equipment. When you're thinking about tires for your new or present car, remember that Firestones, alone, offer the test-winning performance of Firestone Rubber-X, the longest wearing rubber ever used in Firestone tires. Buy now, on convenient terms if you wish, at your nearby Firestone Dealer or Store.

Firestone

BETTER RUBBER FROM START TO FINISH

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*Firestone Rubber-X is compounded specifically for each type of car, truck, farm implement and construction equipment tire.

Have you heard...?

Psst . . . wanna buy a boat . . . cheap? You can. This season outboard makers are going overboard plugging the boat-on-a-budget . . . some for as little as $1,000. Here's how one company (Kiekhaefer) suggests you can make a family of four amphibious:

14-ft. aluminum runabout	$ 375
22-hp. motor (sufficient for cruising and pulling one adult or two kid water skiers)	410
Accessories: (hardware, lights, fire ext., etc.)	90
Trailer	125
Total	$1,000

▶ Willing to spend a little more? Then figure on a more elaborate runabout, maybe fiberglass or plywood ($500 up to $1,200 if you want 16 feet of boat with upholstered seats, convertible top, windshield). A 45-hp. motor with electric starter and generator will run to about $700. Your total's now $1,800-$2,500.

▶ But for a little more you might decide to go to a weekender. Budget for a rig like that might be:

16-ft. cruiser	$1,600
Motor of 50 to 70 hp.	750 to 950
Steering, remote controls, battery	150
"Head," some bunk cushions, hardware and lights, sleeping bags for the kids	250
Trailer	350
Total	$3,100 to $3,300

▶ What about accessories? Here's a rundown on the most vital:

Life jackets for the kids	$6 or $8 each
Buoyant cushions (that will double as seat pads) for adults	$5 each
Lights: red-green combination bow light and white stern light	$25
Anchor	$10 to $15
Whistle or horn	$2 to $25

A gasp of priceless air—about ¼ ounce worth—was the sole cargo of a little Norwegian sailing vessel returned from a Far North trek. The air blew across "Greenland's icy mountains" many millenniums ago and was trapped in pockets of ice. Specialized techniques were used to melt more than 200 tons of glacial deposit to get at the rare residue. With its little bit of dust, pollen, organic material (maybe breaths of long extinct animals), scientists hope to be able to date it (by Carbon 14 count), then determine what climate and life was like then.

Car briefs . . . There's talk of an increase in replacement-tire prices. Sales boomed beyond belief in the last few months. (Winter

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storms sent people on a snow-tire binge for one thing.) Though prices have been stable, Akron is beginning to grow restless.

New gas taxes spur interest in electric cars. Besides the Stinson Town-About [PS, Feb.], trucks are in production in Cleveland. These sell for $4,500, less batteries which rent for $30 a month. Dairies, bakeries and utilities are among the takers. Utilities predict operating costs of under a penny a mile.

GAS OCTANE RATINGS

	Regular	Premium	Super
1948	80.2	86.2	.....
1949	80.5	86.5	.....
1950	82.4	89.0	.....
1951	83.7	89.5	.....
1952	83.1	90.0	.....
1953	84.0	90.9	.....
1954	84.7	91.9	.....
1955	86.2	93.6	.....
1956	88.1	95.6	.....
1957	89.8	96.7	100.7
1958	90.0	98.0	101.1

Source: U. S. Bureau of Mines

Octane ratings have reached new highs according to a Government survey of service stations. Average regular gas rated 90 compared with 80.2 a decade ago. Premium averaged 98 vs. 86.2, and super-grade, not available 10 years ago, averaged 101.1.

The market abounds with car gimcracks and doodads. Latest are candy-striped hubcaps ($8.45 a set). Another is the Protekt-a-dor rubber stopper. Attached to the door's edge, it's to guard against damage inflicted by adjacent car doors on parking lots. Wildest of all is a wildcat—a facsimile animal head clamped under the rear window. Its eyes luminously shine when another car approaches at night—to make driving safer. The firm's sales have been so good they're planning to expand to leopards, elephants, lions and panthers.

Mint-it-yourself toothpaste. Is it okay to brush your teeth just once a day, as some toothpaste makers say? No, says the American Dental Association, which contends that much of today's advertising discourages proper dental hygiene. Testifying before a Congressional committee on false and misleading advertising, dentists stated that there is no substitute for brushing the teeth after every meal. Want their recipe for a perfectly fine dentifrice? Mix table salt and baking soda. Flavor to taste.

What do you save with an "economy" car? PS Senior Editor Harry Walton, who has poked over, pried into, driven and evaluated more than 30 foreign and domestic cars for his new book, "Popular Science Standard Guide to Economy Cars," lists many savings that might not occur to you. Among them: smaller tires; halved costs on oil, antifreeze and spark plugs. And working on the little engines is so simple, usually, that you could—for instance—even tackle your own valve grinding. Careful readers of the book, now on the stands, will have no trouble identifying those makes Walton is crazy about and those he thinks should be melted down into paperweights.

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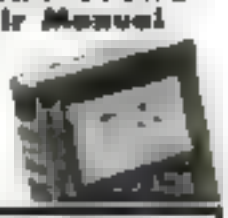

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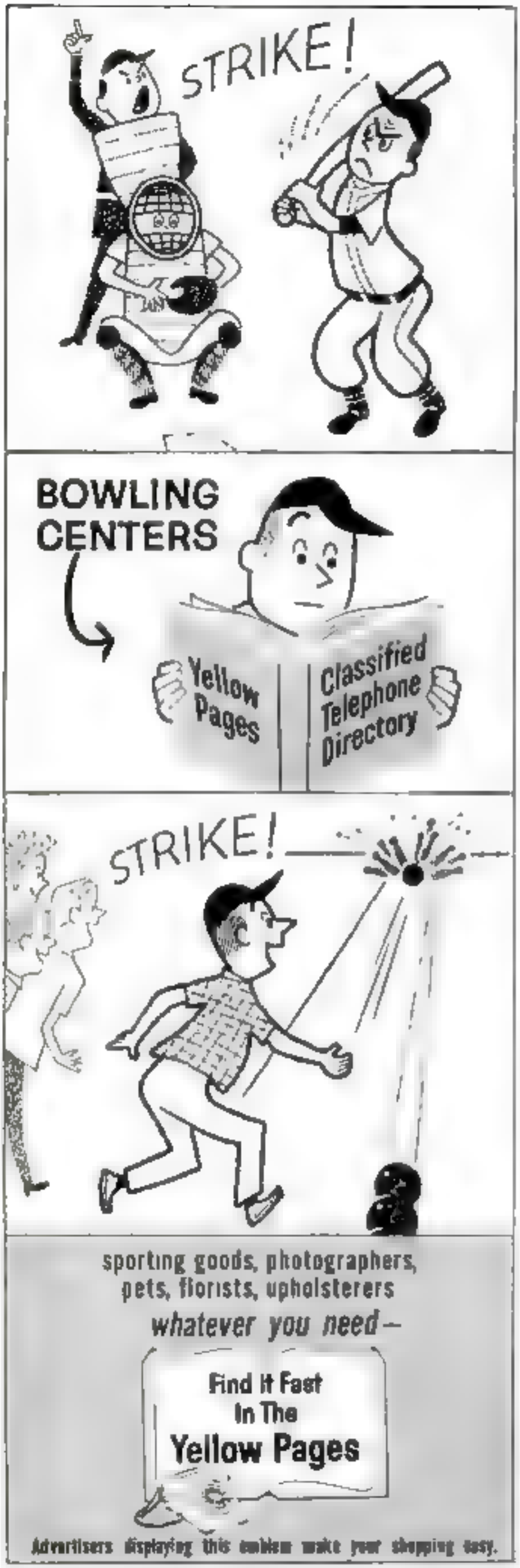

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You are advised first, to make a disclosure of your invention. Date, sign and have this document witnessed by two or more persons who are capable of understanding your invention. The "Evidence of Invention" form mentioned below, we offer as a convenience in making your disclosure and in starting action leading toward patent protection.

Mail your disclosure to the registered patent attorney or agent whom you select to assist you, together with a letter authorizing him to conduct a preliminary search among previously granted U. S. patents for similar types of invention. He then prepares for you a report on the probable patentability of your invention and, if the report is favorable, recommends the further course you should take.

This firm is registered to practice before the U. S. Patent Office and is available to assist you in the preparation and prosecution of patent applications. We shall be glad to send you without obligation, the "Evidence of Invention" disclosure form mentioned above and our instructive booklet, "Patent Protection for Inventors".

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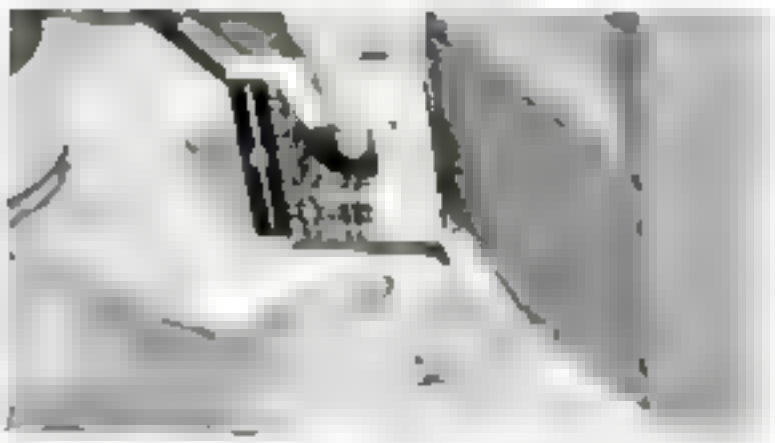

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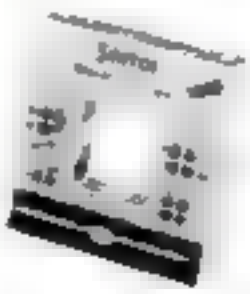

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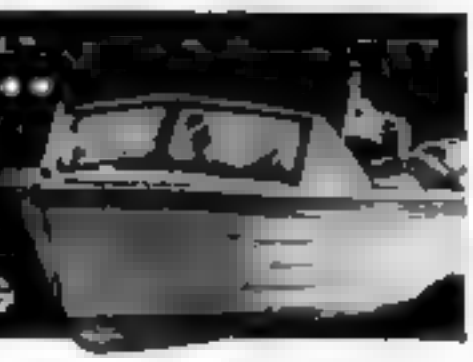

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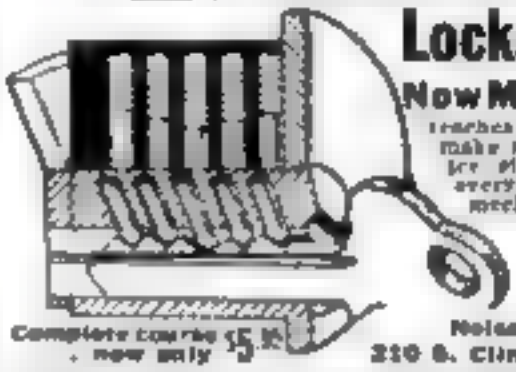

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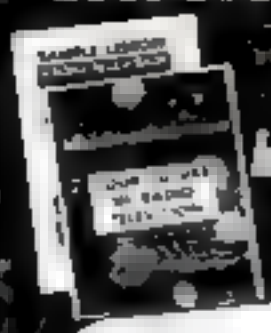

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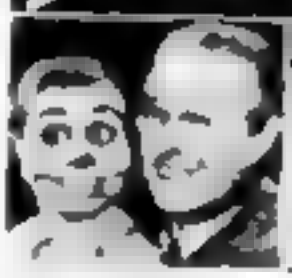

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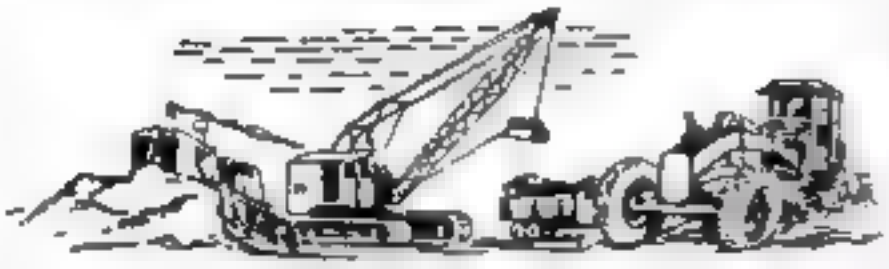

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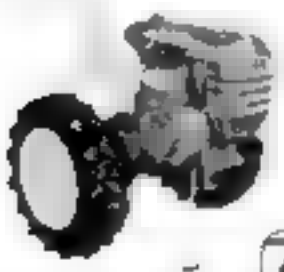

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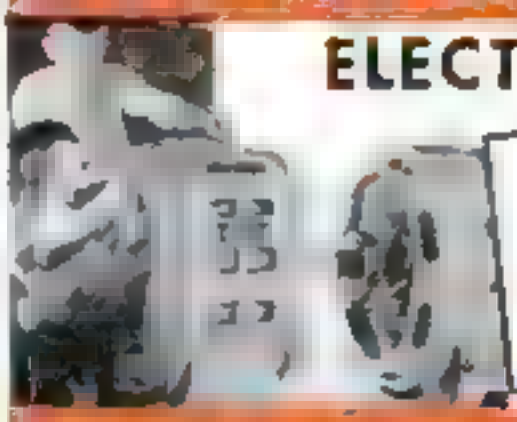

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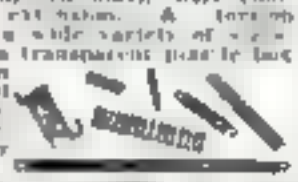

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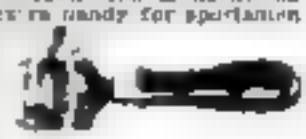

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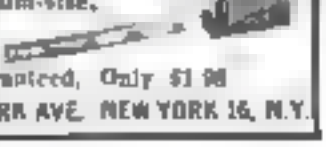

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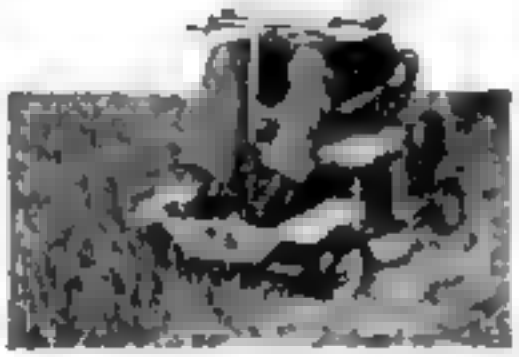

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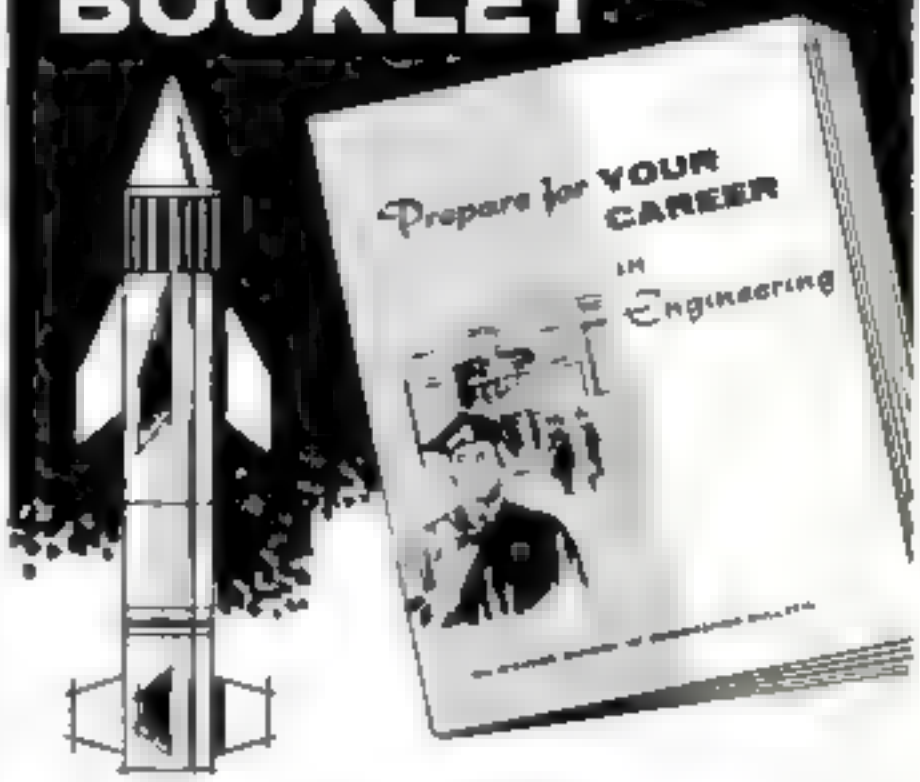

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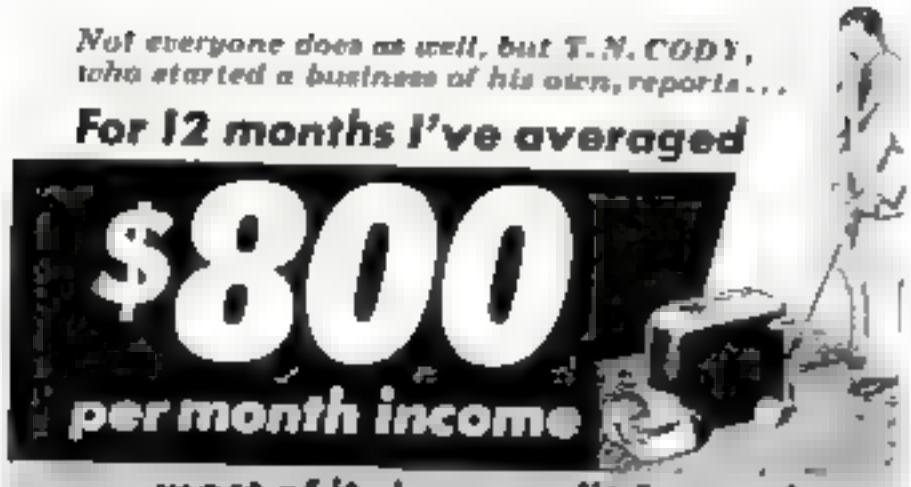

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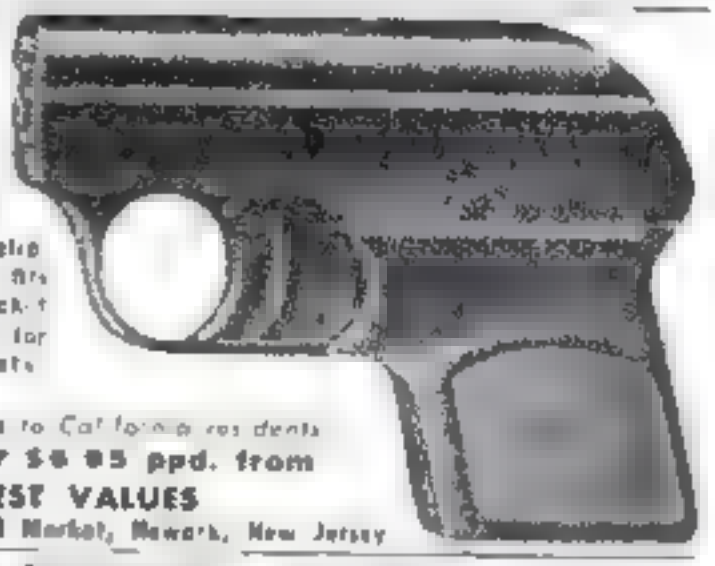

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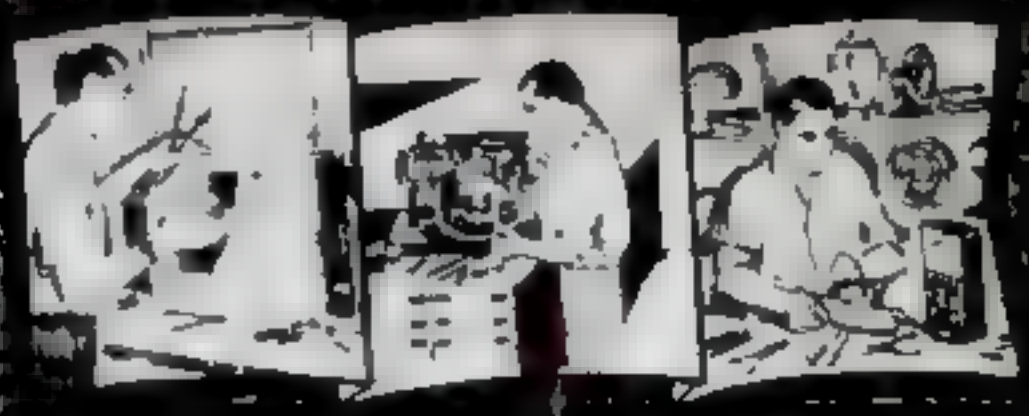

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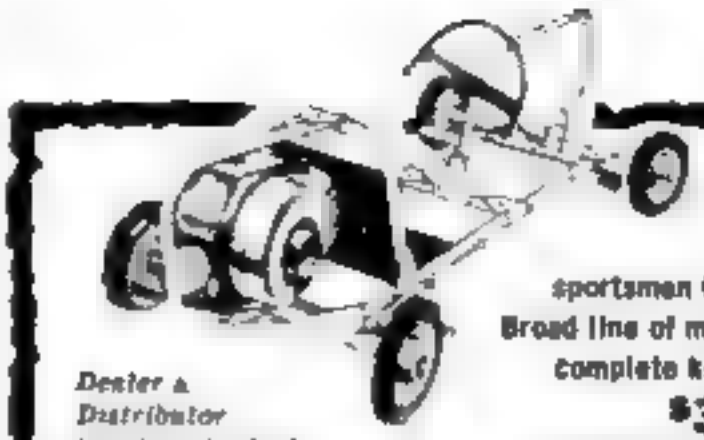

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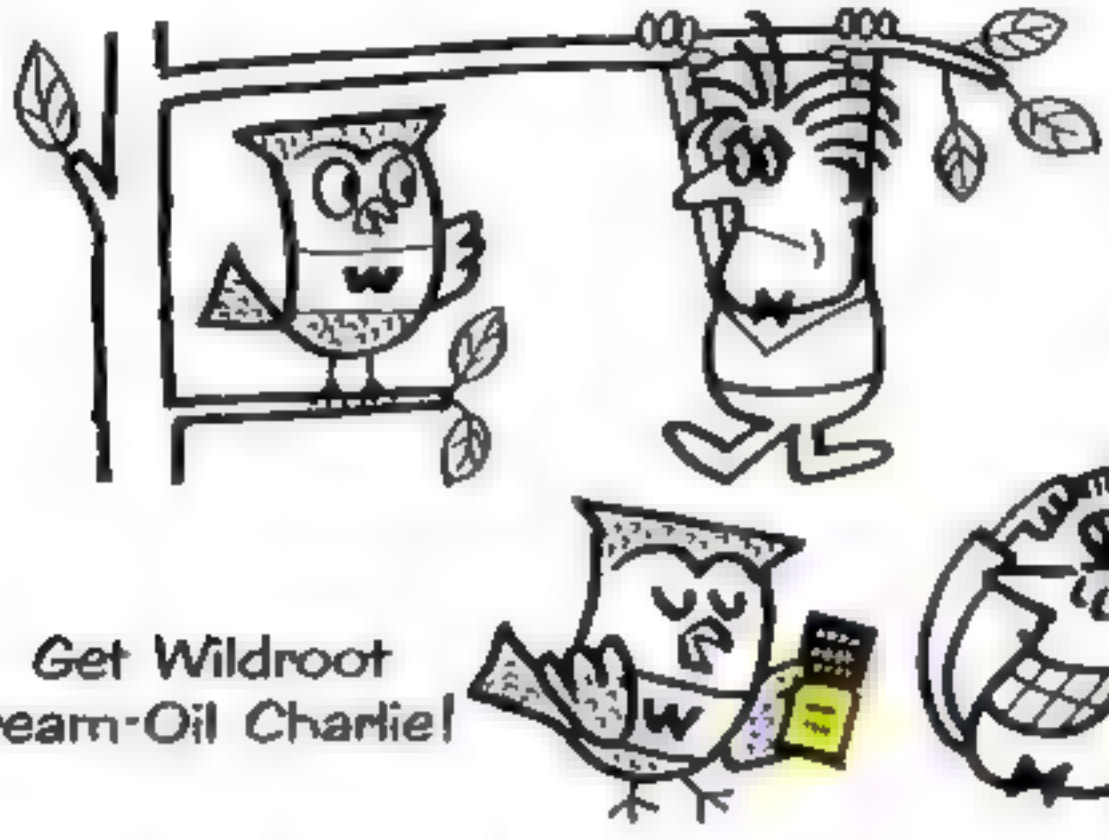

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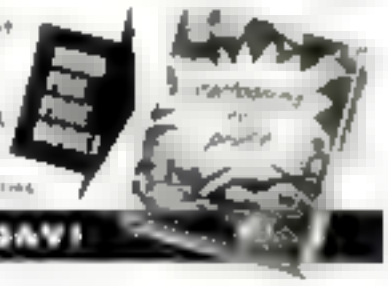

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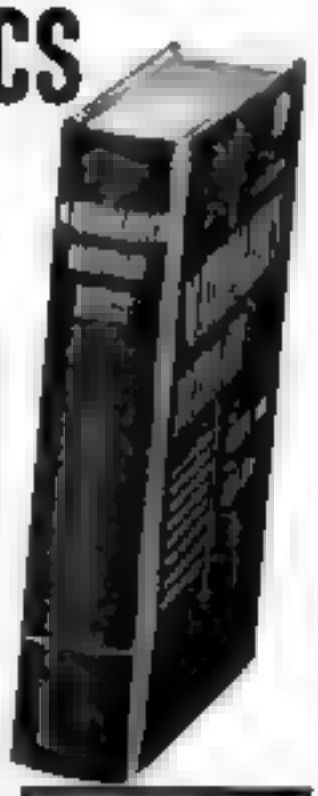

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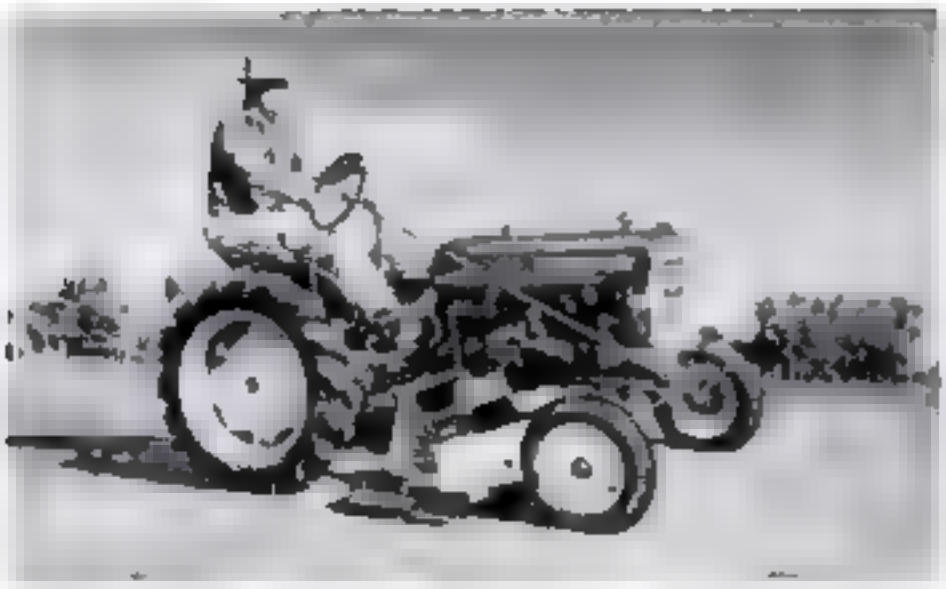

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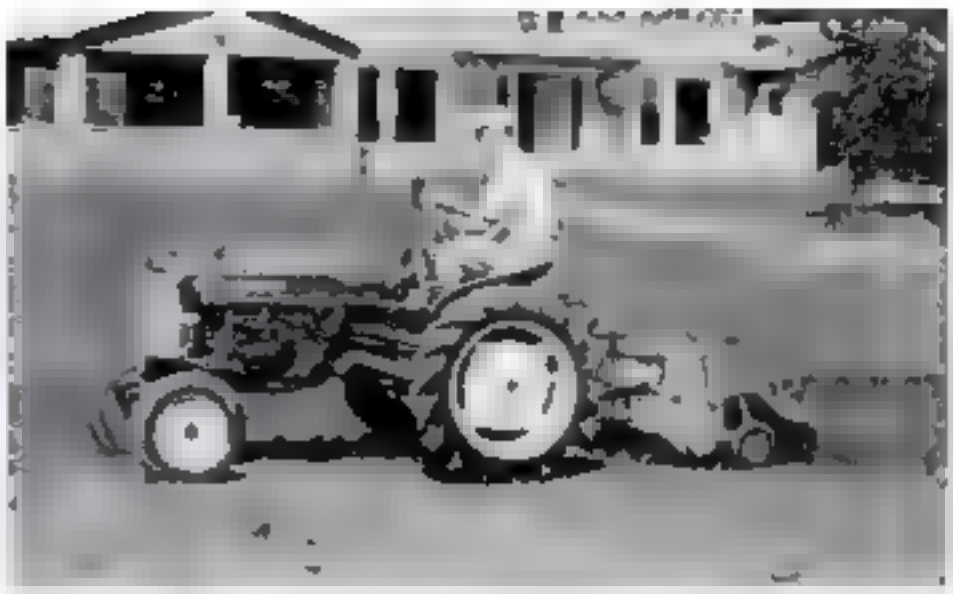

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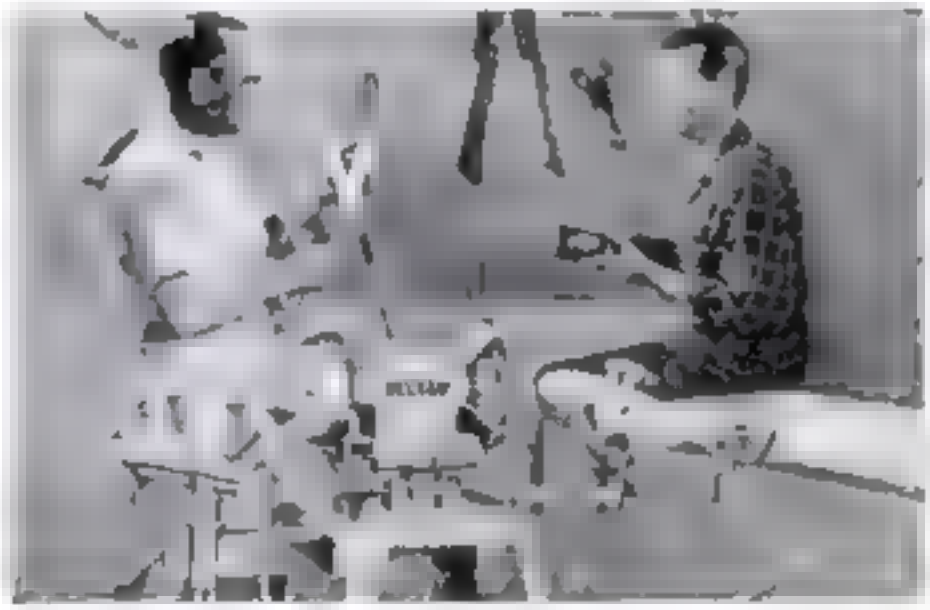

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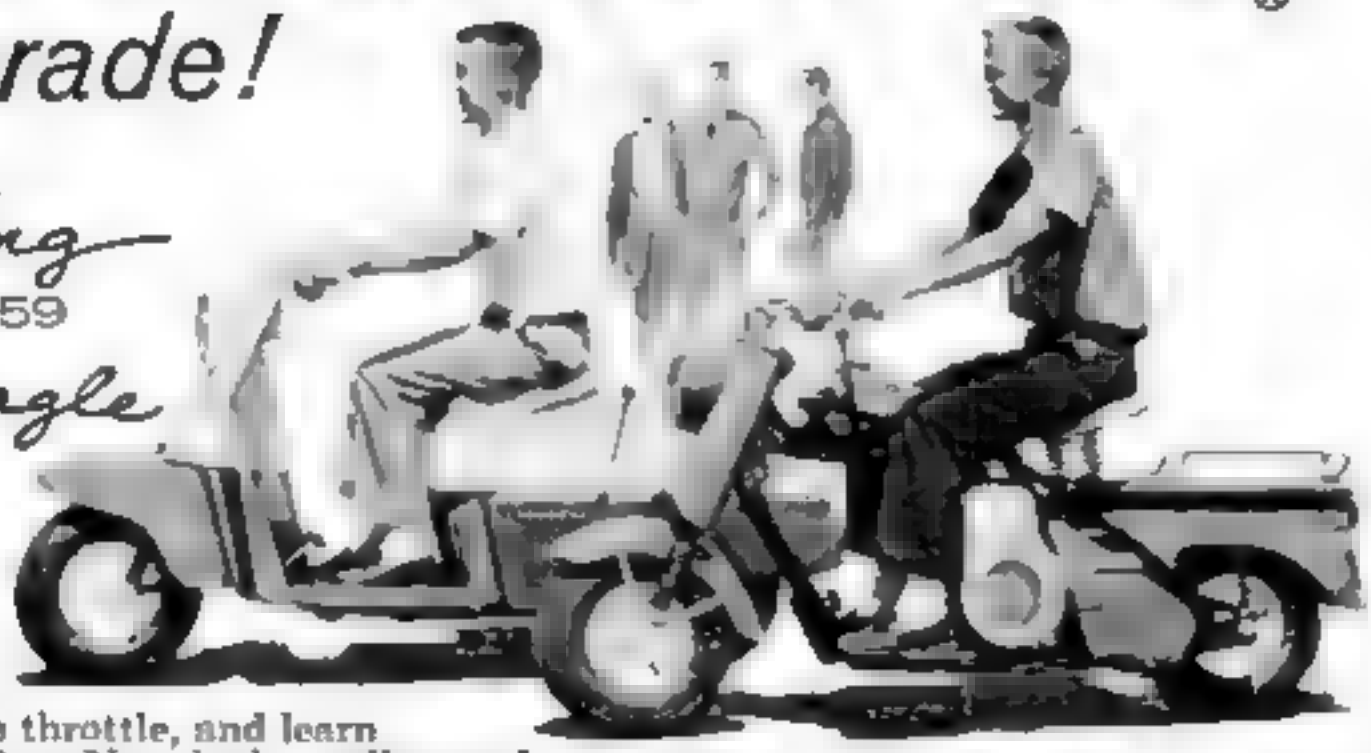

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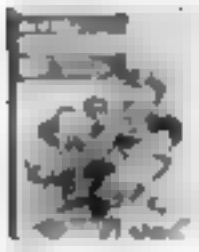

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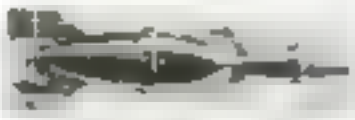

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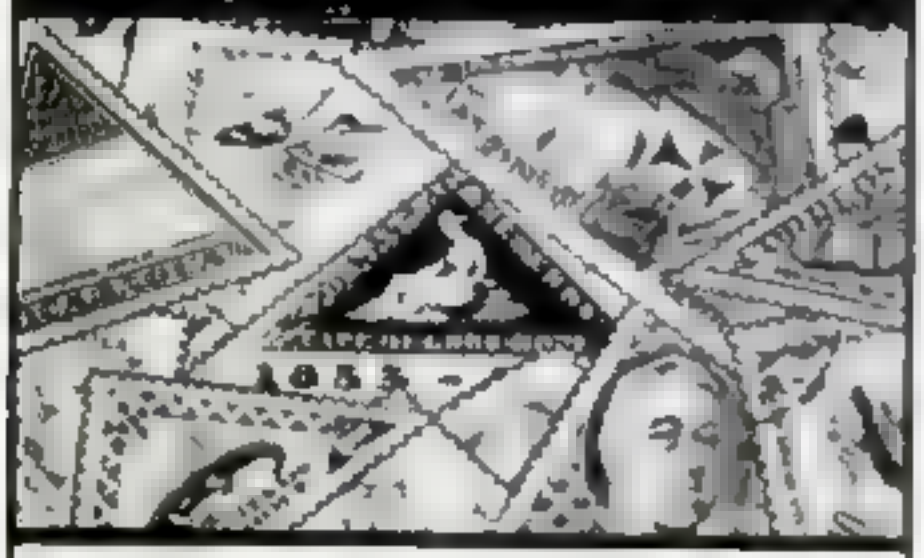

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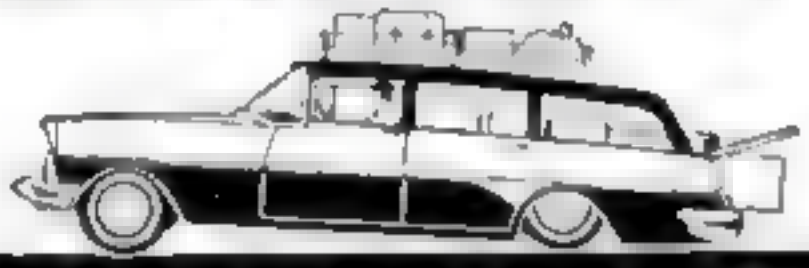

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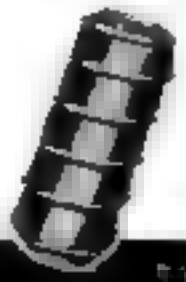

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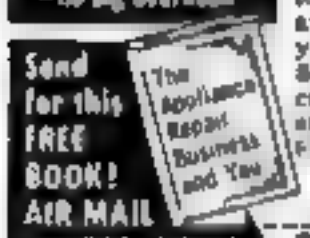

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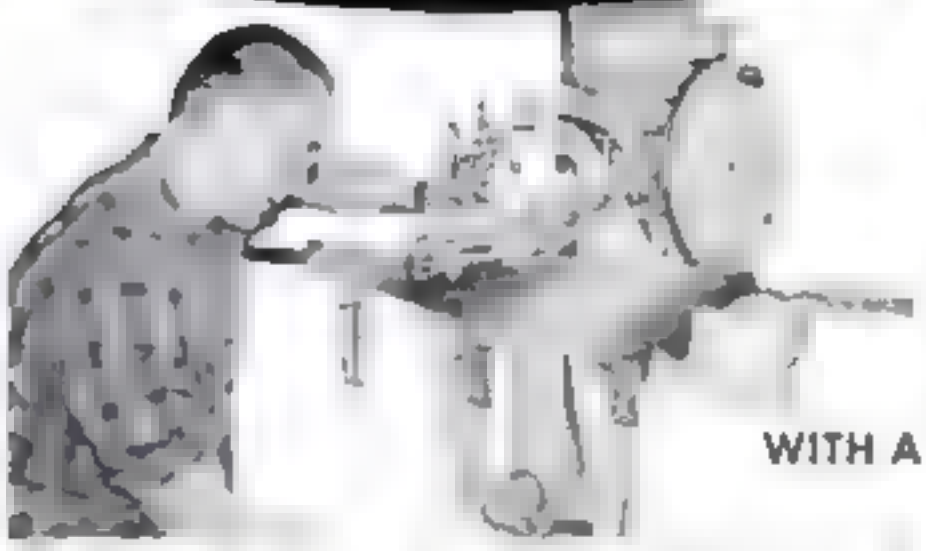

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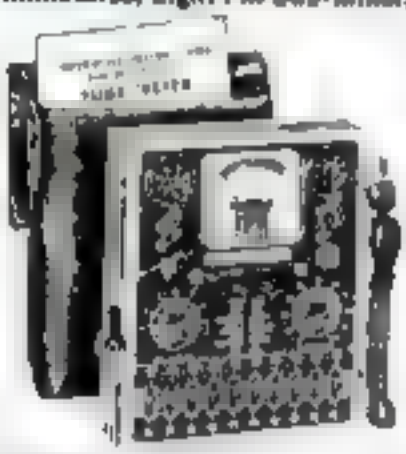

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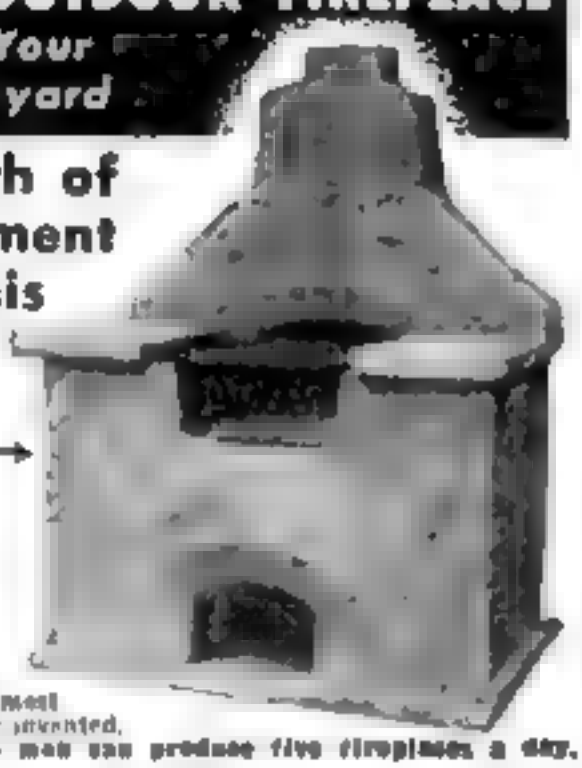

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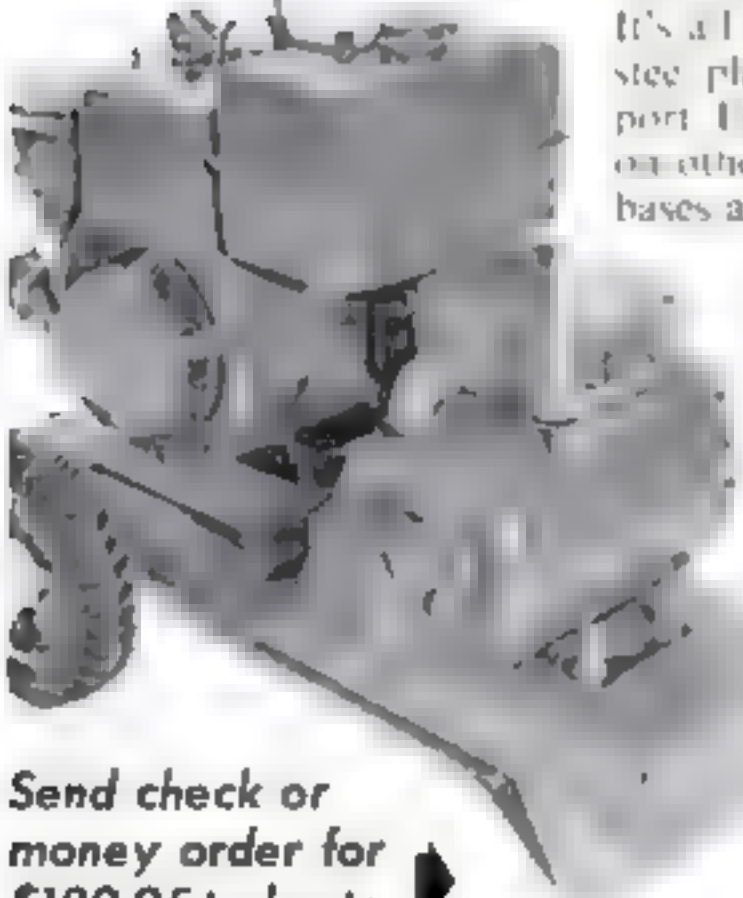

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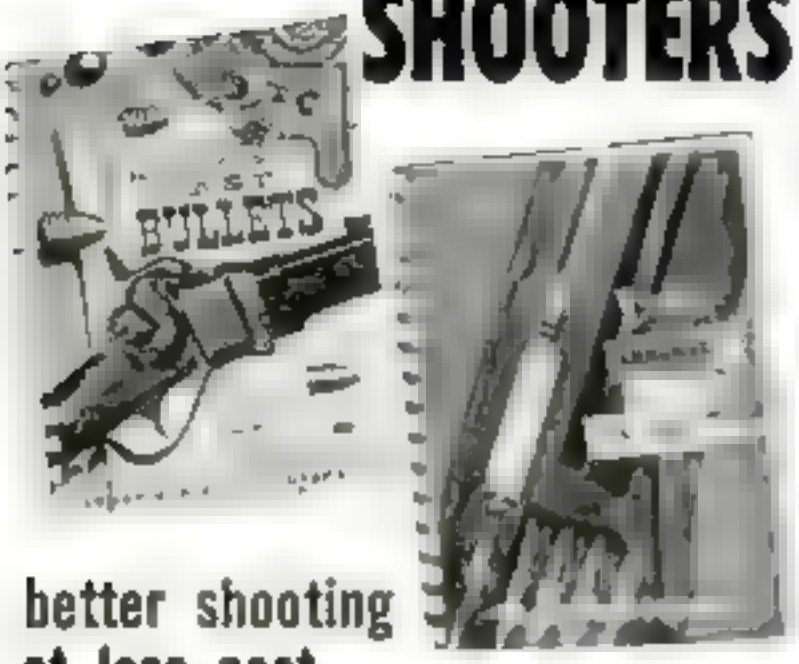

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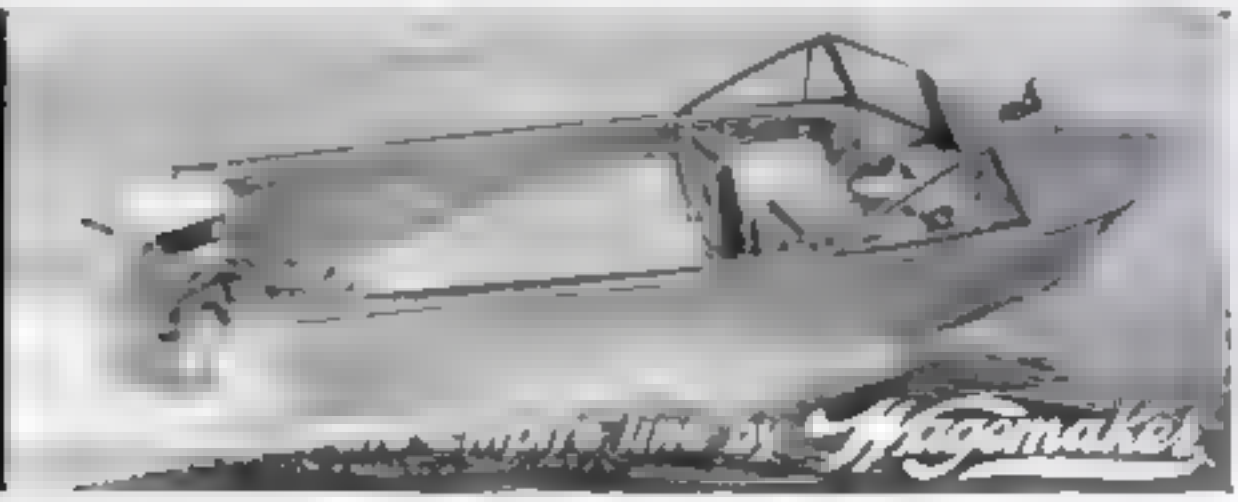

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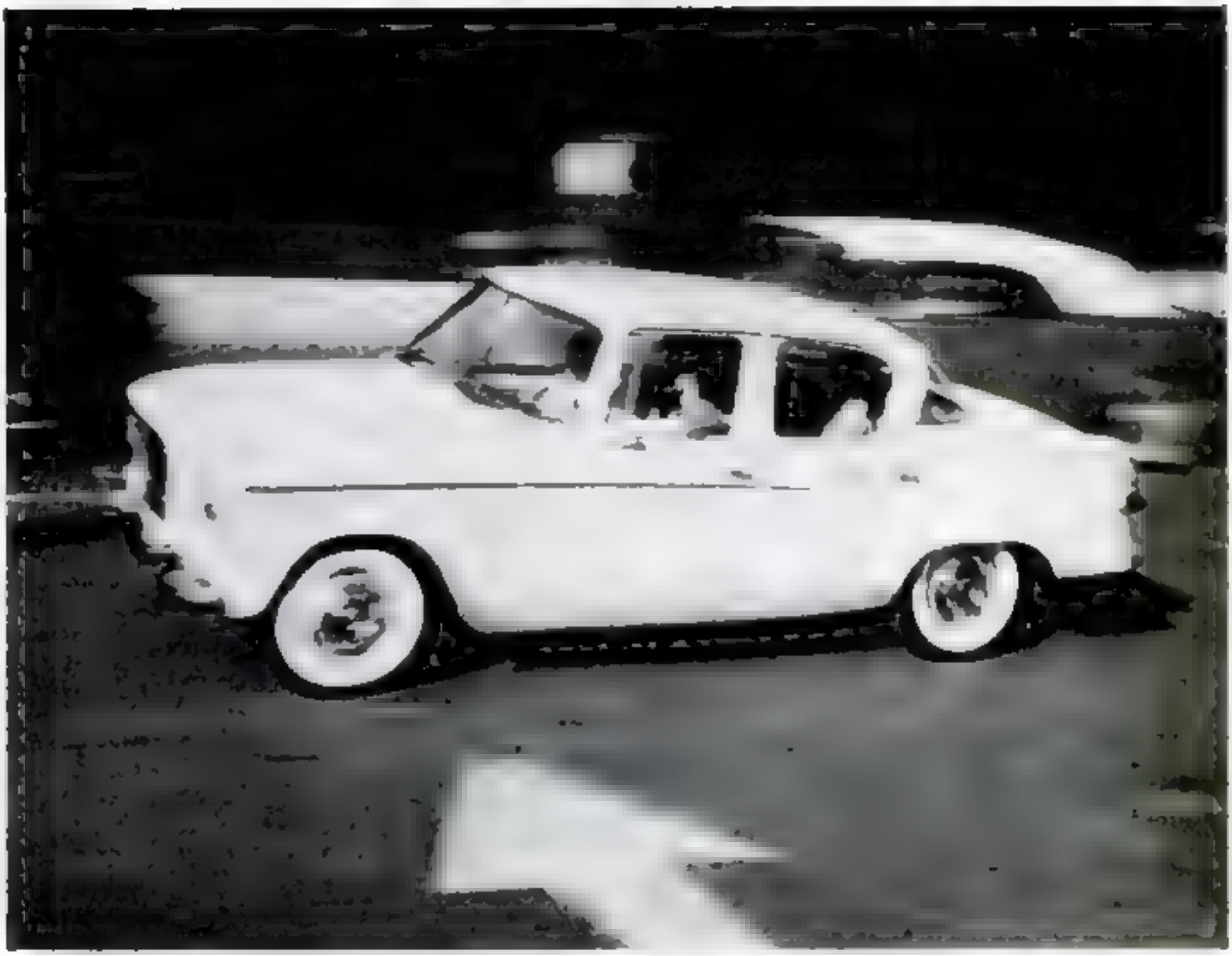

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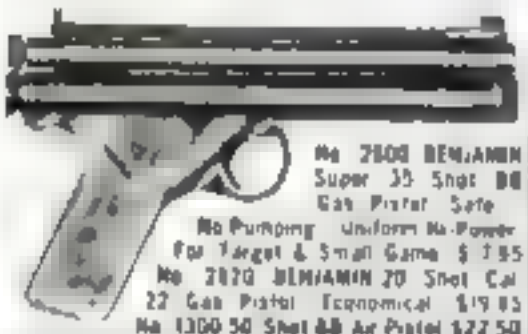

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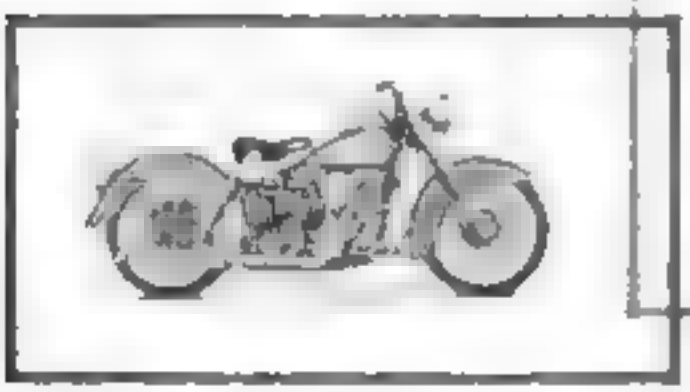

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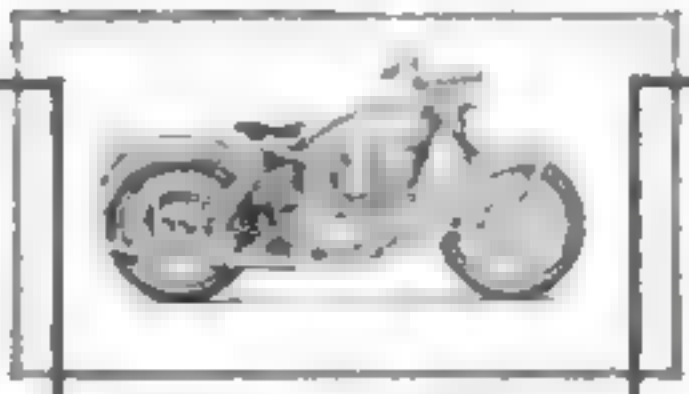

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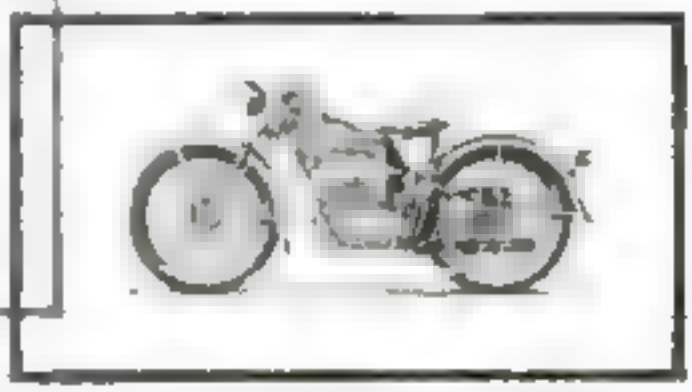

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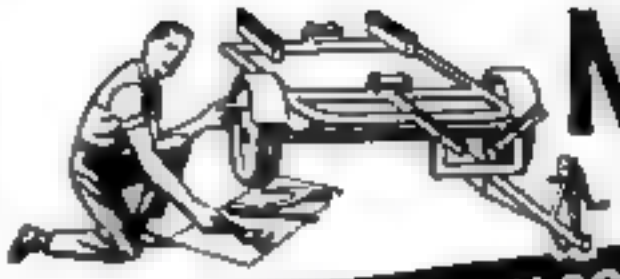

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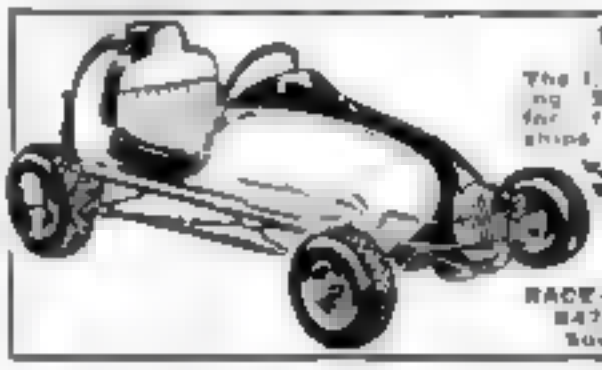

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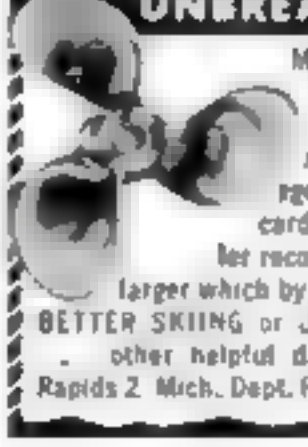

MICHIGAN'S new NI-BRAL props for large motors only, may be nicked but virtually never bent or broken . . . carry 5 year guarantee against breakage . . . eliminate repair lay-ups. Send card for FREE 1959 catalog giving propeller recommendations for motors of 5 HP and larger which by actual test provide far MORE SPEED, BETTER SKIING or LOAD CARRYING than original prop . . . other helpful data. MICHIGAN WHEEL CO., Grand Rapids 2, Mich. Dept. PS-4

A pleasant addition to the art of fishin'

Photographed at Florida's Silver Springs.

dependable MERCURY OUTBOARDS

There's been *new* progress in fishing motors by Mercury *new* freshness of design in the forward *Glide-Angle* look more dependability a water pump specially designed for operation in weeds and mud *Automatic Transmission* that puts shift, throttle and steering control in *one hand!* Weedless *Glide-Angle* Design slides safely over submerged objects There's no 'wrassling' to fix broken shear pins because Mercury got rid of them years ago introducing modern propeller clutches! So go *where* you please *when* you please! Your Mercury is rugged reliable — and quiet as a good fishing companion should be See your Mercury dealer now for a *free* demonstration ride Choose from three *Glide-Angle* twins — 12 hp Mark 28A 15 hp Mark 15A 10 hp Mark 10A They're easy to look at easy to own with the Mercury time payment plan.

MERCURY—the 50,000 mile outboard, the world record line for '59!

Twins—6 hp, 10 hp, 15 hp, 22 hp Fours—35 hp, 40 hp, 45 hp
Sixes—60 hp, 70 hp. Full Jeweled = Power throughout

Write for FREE Catalog and 28 page Booklet Fishing with an Outboard Address Dept PS 4, © 1959 Kiekhaefer Corporation Fond du Lac, Wisconsin

Get satisfying flavor...So friendly to your taste!

NO FLAT "FILTERED-OUT" FLAVOR!
NO DRY "SMOKED-OUT" TASTE!

See how Pall Mall's famous length of fine tobacco travels and gentles the smoke makes it mild—but does not filter out that satisfying flavor!

HERE'S WHY SMOKE "TRAVELED" THROUGH FINE TOBACCO TASTES BEST

1 You get Pall Mall's famous length of the finest tobaccos money can buy.

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Outstanding . . . and they are Mild!

Product of The American Tobacco Company — "Tobacco is our middle name"

Talking Satellites to Speed Mail

Relay stations in space will send your messages overseas—and let you see Europe on TV **By Martin Mann**

PRACTICAL, down-to-earth uses for space satellites are coming faster than anyone thought possible. First job: communications

The talking birds will relay radio messages around the globe, bring you your first look at European television *live* through a transatlantic TV network, and eventually flash your letters overseas by way of a fantastic space post office combining written messages, electronic facsimile and a "stationary" satellite

Futuristic as these ideas seem, they are already

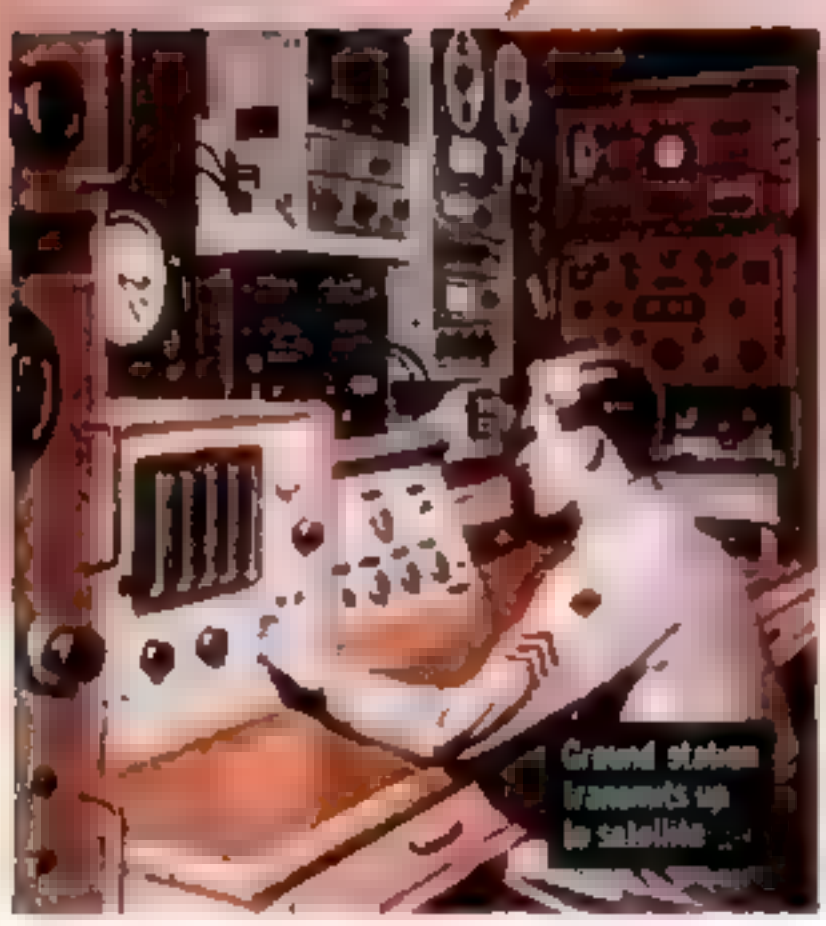
LETTERS FROM HOME flash overseas electronically in half the time, via space post office.

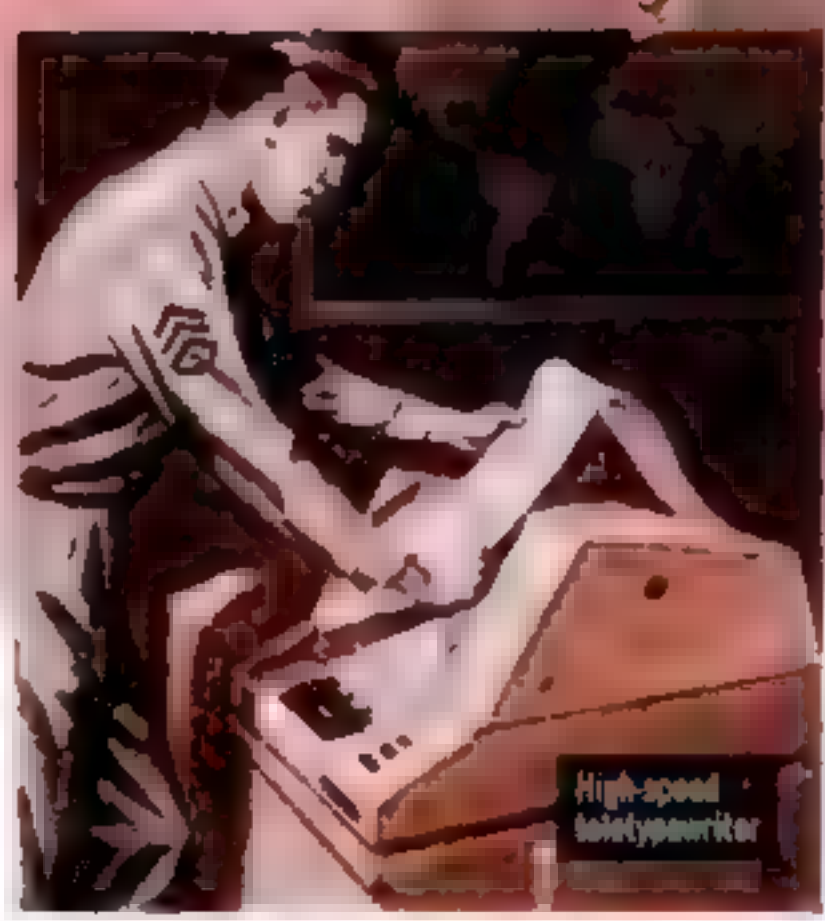
worked into detailed plans. The Atlas satellite that broadcast President Eisenhower's Christmas message from space last December was a test, not a stunt

How soon? Government space agencies have revealed a timetable that changes over rapidly from experimental to working satellites that will earn their keep as routine elements of a worldwide communications net. Here's what will happen:

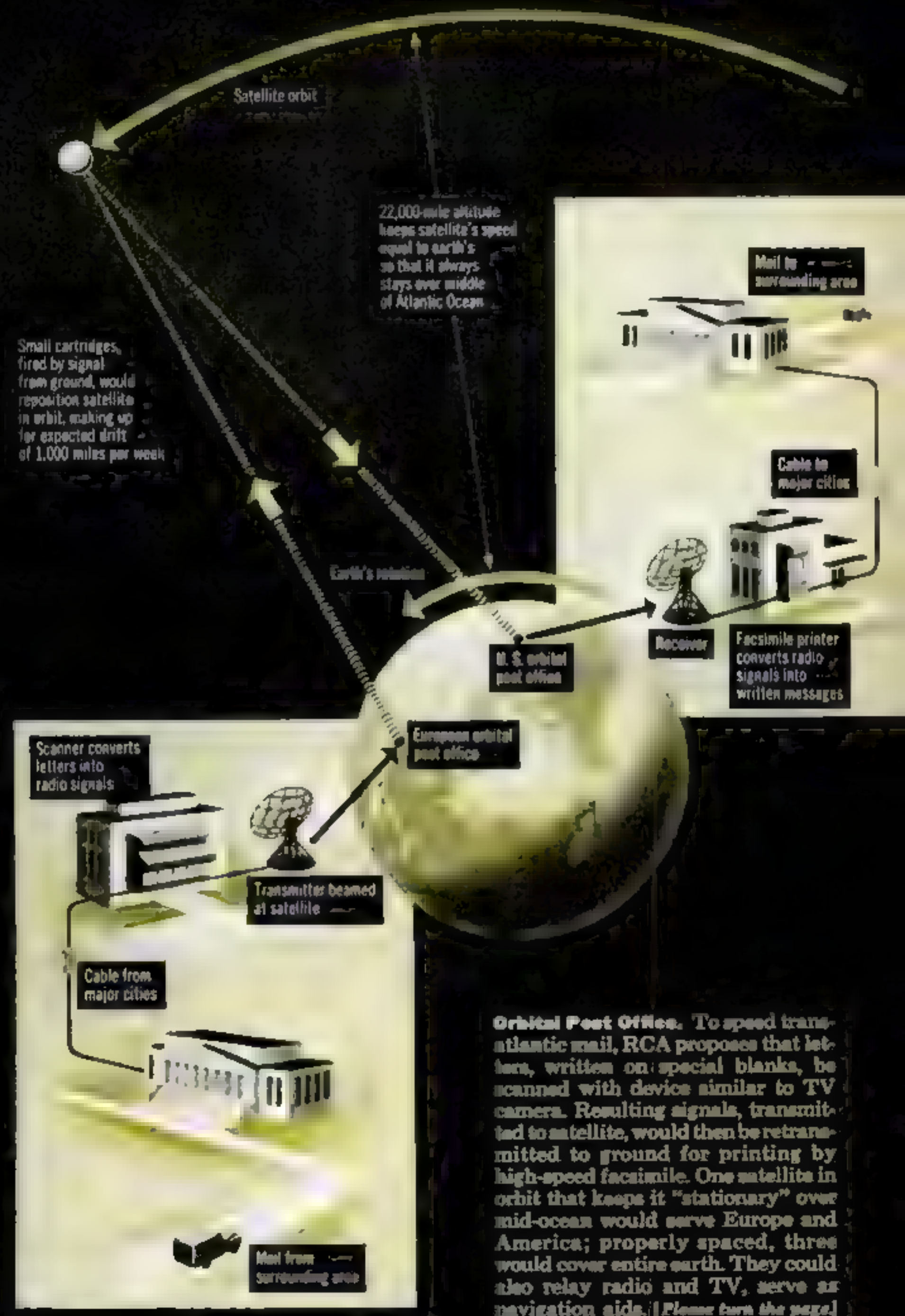
- 1959—this year—The first big plastic-balloon satellite will be launched It will be aluminum-coated to bounce radio signals back to earth
- 1960—Three satellites carrying receivers and transmitters will continue last December's test of "repeating" messages.
- 1961—Repeater satellites for actual use in Signal Corps overseas communications will be in orbit.
- 1962—A five-ton satellite with equip

[Text continued on page 212]

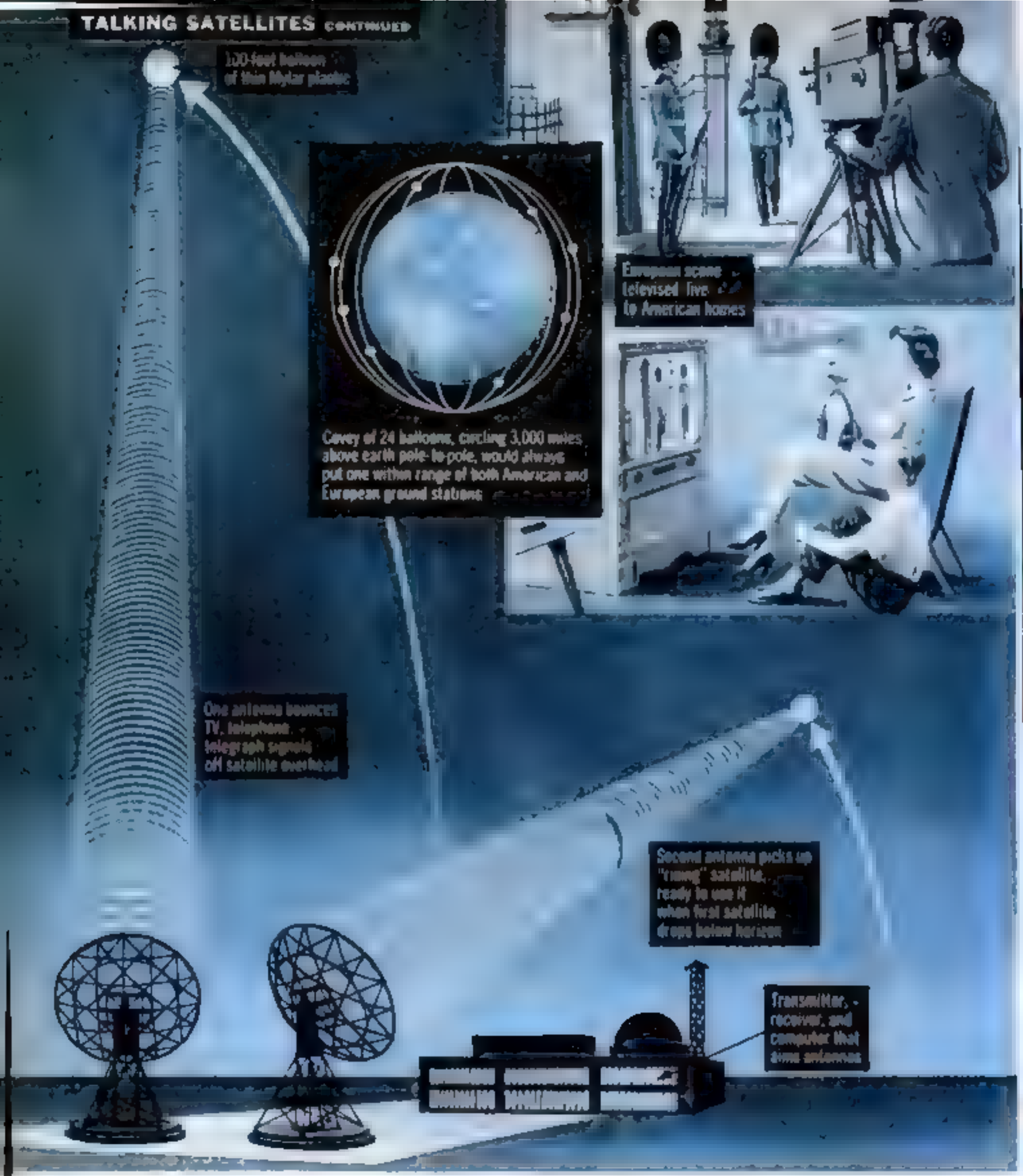




Project Courier will pick up messages at one point, deliver them somewhere else Satellite carries radio receivers and transmitters plus tape recorder. Ground stations track it (aided by beacon transmitter in satellite), and transmit outgoing messages when it comes into range Tape recorder takes them down. Farther along in orbit, as satellite comes into range of another ground station, that station signals for its messages to be read off tape and transmitted down to ground This is a scheme that the Signal Corps plans to have in operation by 1961



Orbital Post Office. To speed transatlantic mail, RCA proposes that letters, written on special blanks, be scanned with device similar to TV camera. Resulting signals, transmitted to satellite, would then be retransmitted to ground for printing by high-speed facsimile. One satellite in orbit that keeps it "stationary" over mid-ocean would serve Europe and America; properly spaced, three would cover entire earth. They could also relay radio and TV, serve as navigation aids. [*Please turn the page*]



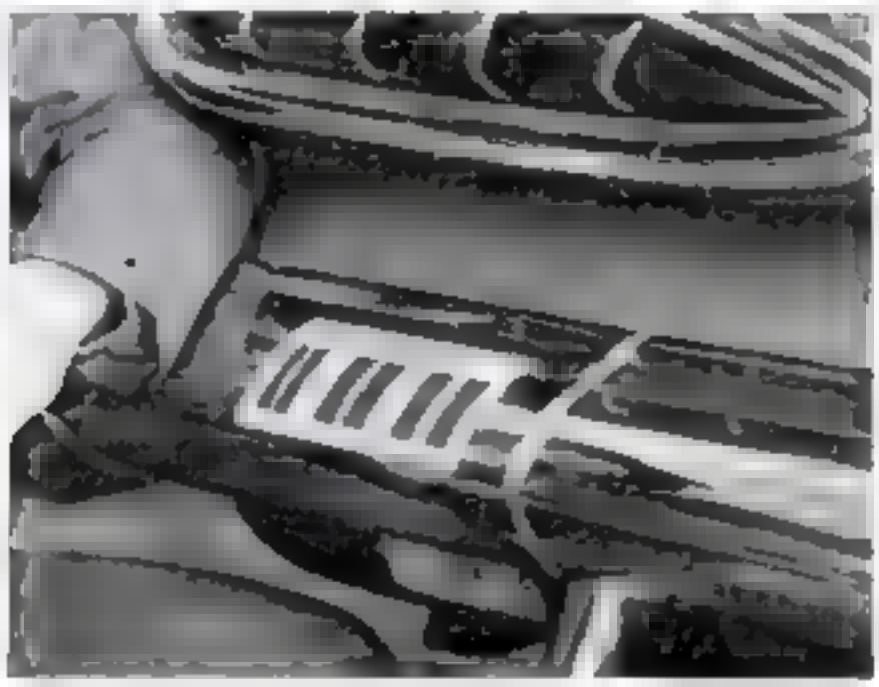
Mirrors in Space. Simplest way to relay heavy load of transatlantic TV and phone traffic is to bounce short radio waves off big shiny satellite, the way light is reflected by a mirror. All radio apparatus is on ground, none in satellite. This gives nearly limitless capacity since ground stations can use many channels at different wave lengths. Reflected signal would be extremely weak, and ground equipment becomes very complex: ultrasensitive receivers with molecular amplifiers, giant antennas, computers to predict where mirrors will be.

MIDGET CYCLE. A seven-hp. motorcycle engine powers this half-pint, homemade motorbike. Quick on the take-off, it can do 40 m.p.h. It has no brake. To stop, you put both feet on the ground and lift the machine.

NIGHT LANDING. Floating high-intensity lights here mark a safe channel for seaplanes approaching the modernized seadrome at the Naval Air Station at Norfolk, Va. The new all-water runway is 13,500 feet in length.

TRAFFIC TIMER. A flashing electric sign under the traffic signal light above ticks off seconds to let Tokyo motorists know time left before the green light changes to red, and vice versa. The installation cost $1,400.

DRIVE PATTERN. Time shot of a light on the selector lever of Ford's new tractor transmission shows (right) operation for 10 forward speeds. The power-shift unit needs no clutch pedal.



ANTI-TAILGATER. The pairs of vertical lines on this bumper strip warn a trailing driver of his distance. Each pair looks like a solid line until he is (right to left) 300, 150 or 75 feet away.

LUGGAGE EXPEDITER. Containers holding 20 bags fit the contour of the cargo compartment of American Airline's Electra turbojets. They speed loading and unloading of passengers' belongings.

Bored with traveling in a living room on wheels? Don't let folklore stop you from buying that convertible you covet

I Say Convertibles Make Sense

By Hubert Luckett

You'll be giving the paintwork

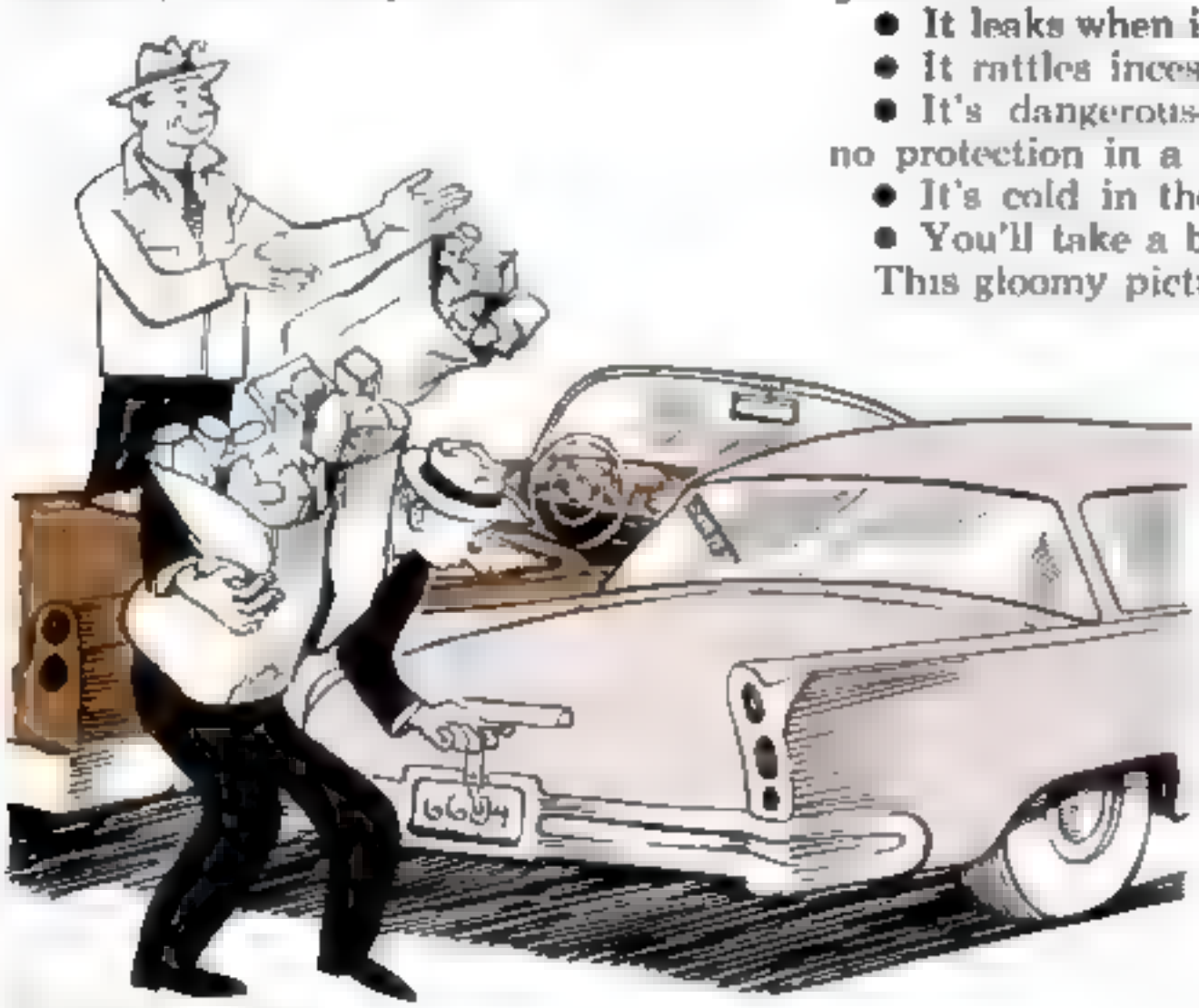
CONVERTIBLES have much in common with those movie starlets whose curves often decorate the pages of the tabloids, but whose faces you never see in the movies. They can claim the dubious distinction of being the most looked at, but most neglected in the department that pays off. They seldom get a chance to show their real talents to the paying customers.

Chances are, if you are like most people with a lively interest in hobbies and more than a passing interest in automobiles, you are one of those who looked, admired, and secretly coveted a convertible—but bought something else. Your dreams of four-wheeled glory were no match for the tired, but durable folklore perpetuated largely by curbstone experts who have never owned what they derisively call a "rag top."

They say:

- You have to buy a new top every year.
- The operating machinery always gives trouble.
- It leaks when it rains.
- It rattles incessantly
- It's dangerous—the soft top gives no protection in a roll-over.
- It's cold in the winter.
- You'll take a beating on trade-in

This gloomy picture of the convertible



Weekend errands can be almost a pleasure. One boon: no package-juggling to free a hand for the door handle —just dump them over the side into the back seat.

a last loving swipe, while your neighbor is still laboring on acres of sheet metal.

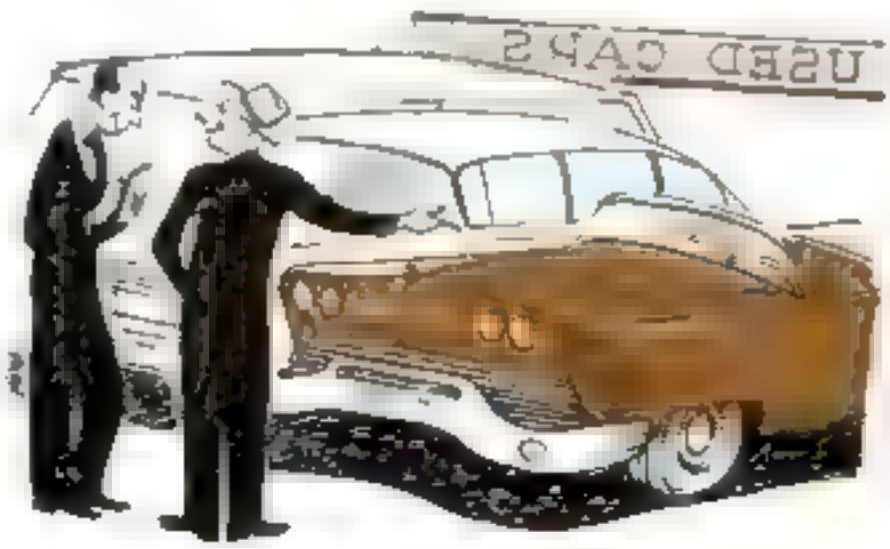
is painted mostly from eyewash, and based on "information" that is as dated as a straight-eight engine. But if this is not enough to stop you, there is always the chap who gets the latest word on everything. He'll confide that Motivation Research has discovered that owning a convertible is the expression of a secret desire to keep a mistress. If you like to think of yourself as a practical, mature and reasonably moral citizen, you don't stand a chance of getting away with buying more fun with your car dollar.

From one who owns one. About the only ally you can find is a contented owner who has bought a convertible in the last couple of years. The car makers themselves are not much help. In their sales pitch they use a convertible much the way other advertisers use pictures of pretty girls: as an eyecatcher for their more prosaic products.

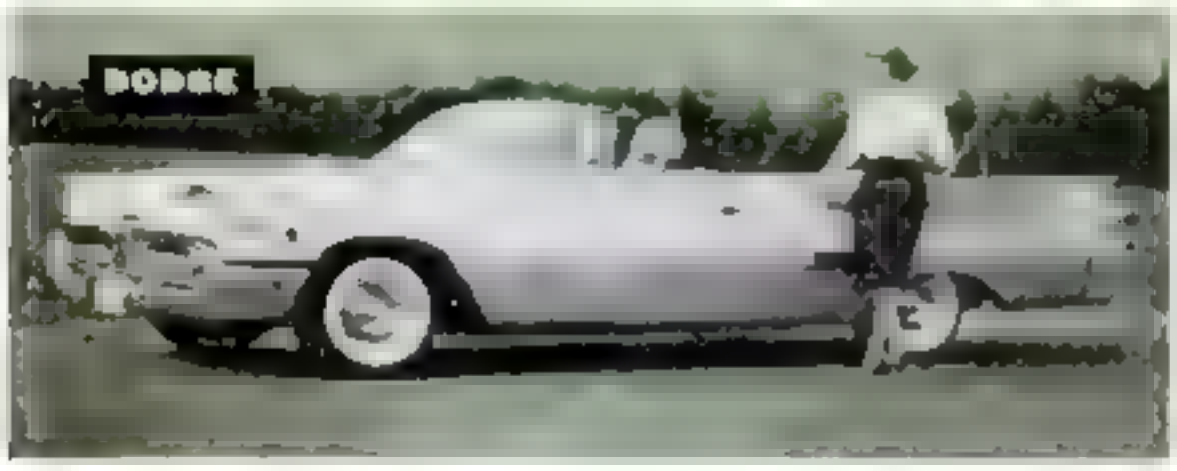
I have talked to many car buyers since I bought a convertible a little over two years ago. Of course the overwhelming majority owned station wagons, hardtops or sedans. With tiresome regularity, when the subject of convertibles is brought up, they will recite the dismal catalogue of woes listed above. An occasional more imaginative type may add one or two to the list. And yet, except for a handful who had owned a convertible back in the '30s or '40s, not one of these "experts" had first-hand experience to verify the imagined ills a convertible is heir to. On the other hand, there is only one complaint out of this list that was mentioned by convertible owners: It is prone to rattle.

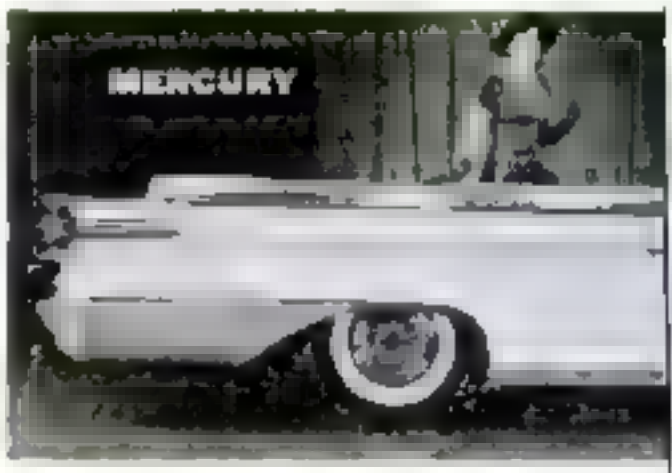
I'll go along with this from my own experience. My convertible rattles almost as much as my neighbor's hardtop of the same vintage. On a rough road the din is only slightly less than the rumble in my brother's station wagon.

What about safety? This angle is a tough one to get a hard answer on. But, a canvass of the major safety agencies and insurance companies failed to turn up any evidence that convertibles are any more dangerous than any other car. Cer-



Poor resale value? Just a fiction. Dealers' book of Official Used Car Valuations shows that convertibles fare as well or better than other models.





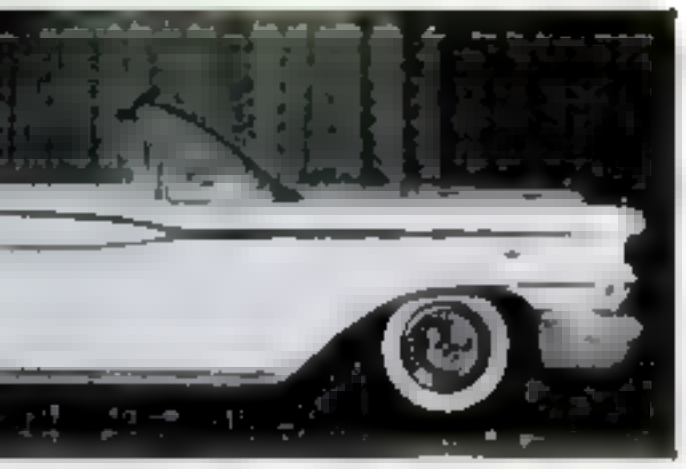
Here are a dozen ways to buy more fun along with transportation. While still less

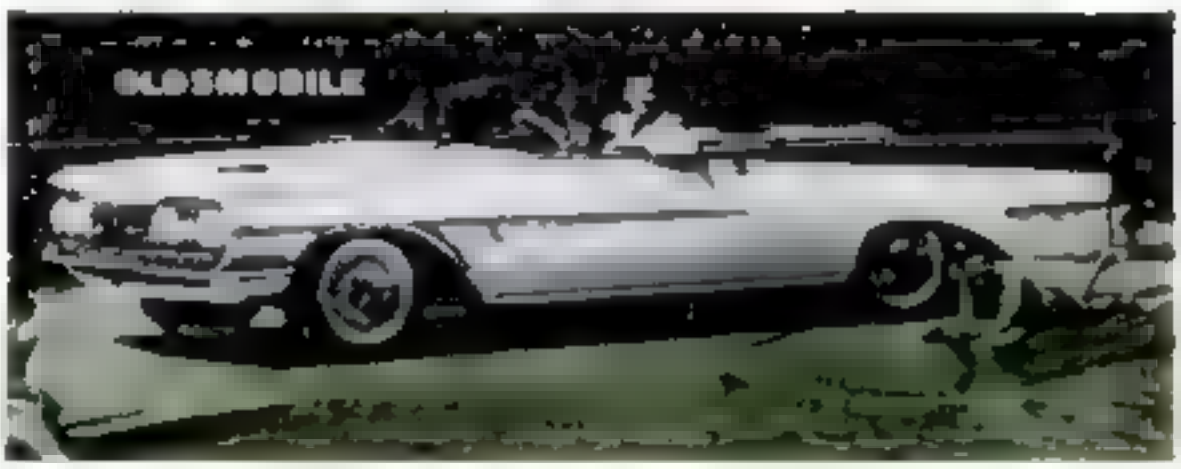
tainly, as far as a hardtop is concerned, any engineer will tell you that the protection afforded by that thin, unsupported piece of sheet metal is largely illusion.

The story of poor resale value is pure fiction. A check of the used-car dealers' book of *Official Used Car Valuations* shows that convertibles fare as well and sometimes better than other body types.

The champions of the soft top won't take much of your time just rebutting arguments. They are likely to take it for granted that you know you can be just as snug and comfortable in a closed convertible during bad weather as in any other car. The point is not that it is just as good as any other for routine duty-driving, but that it gives new dimensions to the pleasures of owning a car, along with unsuspected practical advantages.

Proof of the pudding. Suppose you had bought that convertible. The first





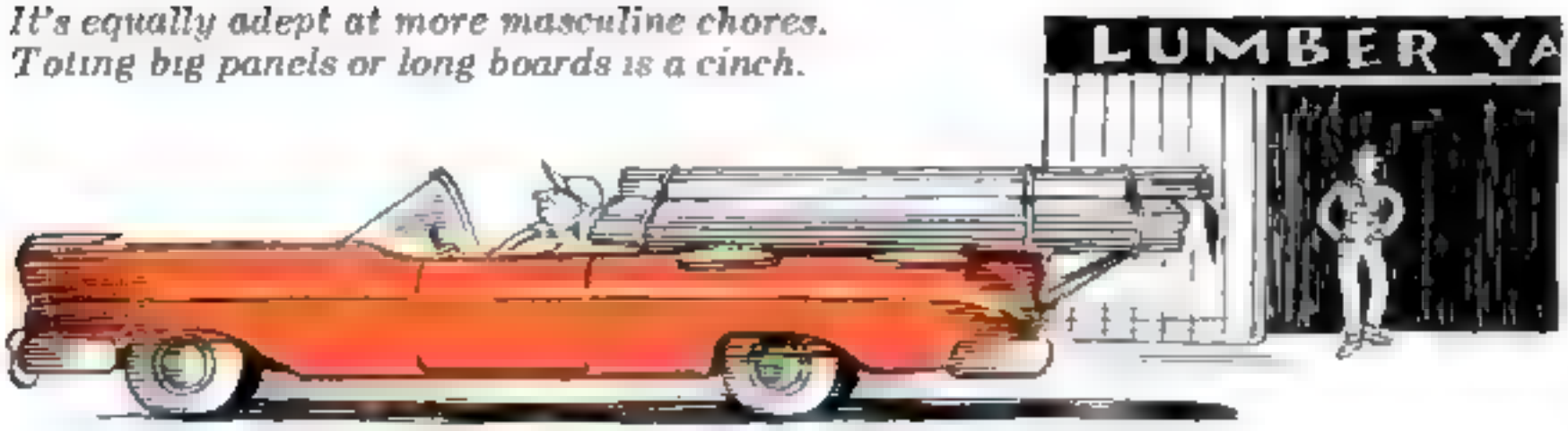
than five percent of the total, convertible sales have climbed from 2.9 percent in '56.

warm weekend in spring would probably find you, like other householders up and down your street, out early Saturday morning polishing your car. You'll be giving the paintwork a last loving swipe while your neighbor over the hedge is still laboring on the acres of sheet metal on his station wagon and your buddy across the street is just mounting a step stool to polish the roof of his sedan.

Snug the boot down over the folded top and you're ready to drive away in a smart, trim car that many of your friends won't even recognize as the same car you drove all winter.

Count your blessings. First off, there's the matter of weekend errands for the wife—the cleaners, shoe store, post office, supermarket, newsstand, drugstore—perhaps a dozen stops in an hour's time. Shoehorning your way in and out of parking spots is no problem when you can see exactly what you're doing, and it is surprising how the bother of climb-

It's equally adept at more masculine chores. Toting big panels or long boards is a cinch.



ing in and out of a car disappears when you don't have to fold double to get out from under a roof. When you return to the car with arms loaded, there is no juggling of packages to free a hand for the door handle—just dump them over the side into the back seat.

It's equally adept at more masculine chores. Have a hurry-up need for a four-by-eight plywood panel? Just toss a couple of old cushions in the car and take off for the nearest lumberyard. With the cushions to hold the panel off the folded top and protect the paint on the rear deck, the panels will ride easily, placed lengthwise over the rear seat and out over the trunk. If it's long two-by-fours you're after, you can carry them safely even with the top up. Just unzip the back window and they can extend from the front seat to beyond the rear bumper.

If you're the boating type or have any other frequent need to haul a trailer, you'll find the open convertible gives you a rapport with that sometimes troublesome vehicle that makes maneuvering it a breeze.

Then there's the kind of furniture moving that no family man can reasonably hope to avoid. Whether it's returning a baby carriage to Aunt Suzie, bringing home that bargain TV set from the discount house, or coping with the grandfather's clock that your wife simply couldn't resist at the auction, every family car frequently has to make like a moving van. The convertible does this more gracefully than most. Remove the rear seat and cover the top-elevating machinery with a piece of plywood, and you have the next thing to a pickup truck. With the top down, you can walk upright into the car with your burden or hoist it over the side. Headroom is limited only by low-hanging tree branches.

Auto ads scarcely soothe a Puritan conscience. They use convertibles as other advertisements use pretty girls.

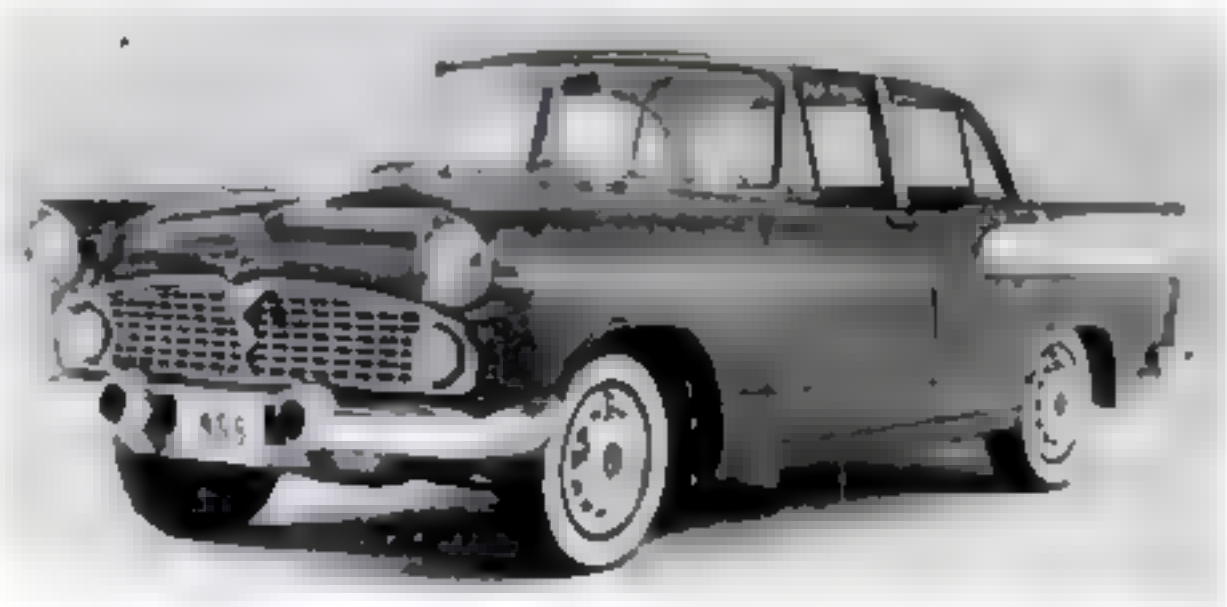
And amateur photographers will find that the top-down convertible gives them access to more different and exciting pictures than a police pass. Standing in a convertible, you can shoot over the heads of a crowd, get pictures from the middle of a busy street and grab shots from dozens of vantage points where you wouldn't be permitted afoot.

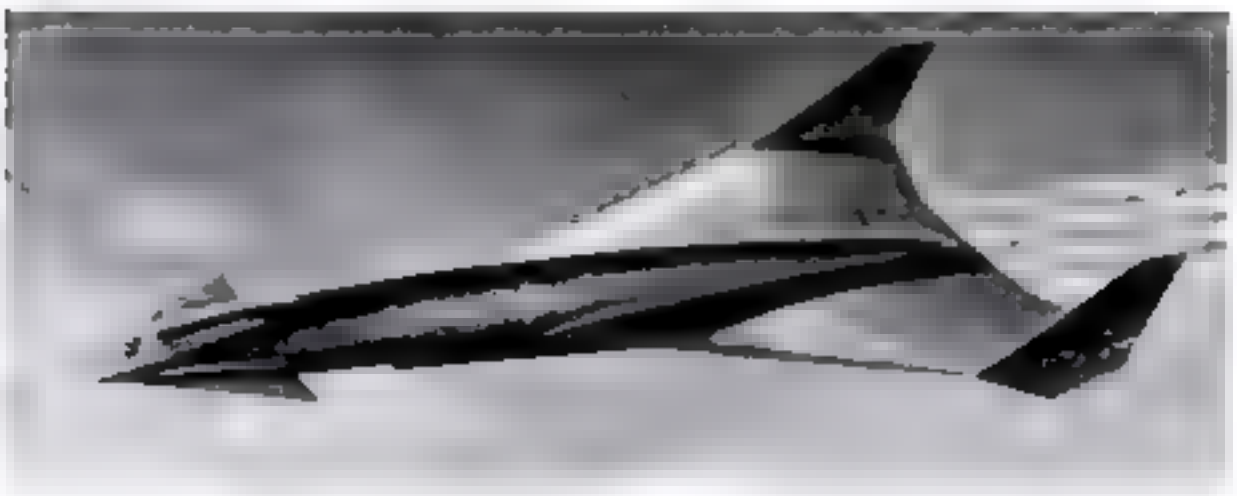
These are but a few of the hidden talents of a convertible—enough to soothe the Puritan conscience and satisfy the hard-headed practical man. But the real reason that the convertible appealed to you in the first place is that it promises an end to the humdrum monotony of carrying your own private little environment with you no matter where you travel. It lets all of your senses bring you the pleasures to be had in the going. The warmth of the summer sun, the cool of the mountain air, the sweet smell of honeysuckle, the salty taste of ocean breezes, the chuckle of a roadside brook, the rumble of the restless surf—no matter where you go there is a wealth of sensations that, added to the unimpeded view, brings quiet new joys to the pleasures of motoring. END

MAKE-DO BRIDGE. GIs in field training at Fort Hood, Texas, improvise from what they have. Above a pontoon is made of sticks lashed in pup-tent halves; at right rope and sticks make the tread.

ROCKING SEAT. Passengers on Sabena's transocean jets will be tilted back horizontally with knees up so they can absorb shock and escape injury in case of a crash landing. The new seat, designed by a Sabena engineer, can be adjusted to any position for reclining or sleeping. A sudden impact will automatically tilt it all the way back.

PARIS IMPORT. The 1959 Vedette Beaulieu at right, latest in the Simca line, is a six-passenger, four-door sedan with a 106-inch wheelbase. Competitive with Lark and Rambler, the French car has an 84-hp. Aquilon V-8 engine, very similar to the old flat-head Ford V-8.





DREAM JET. This concept by Convair of an airliner designed for 1970 would streak the skies 60,000 feet or higher at a speed three to five times as fast as sound. Various configurations are now undergoing wind-tunnel tests.

Discovery of cold cathode promises new electronic magic, including—

TV Tubes That Won't Burn Out

ICY BLUE GLOW is the hallmark of new cold-running vacuum tube, contrasting with red-hot incandescence of ordinary tube. Blue light comes from electrically "excited" atoms in cathode of

TANTALIZING electronic dreams are coming true fast because of a brand-new kind of vacuum tube. Unlike ordinary tubes, which run hot, this tube runs cold. That's the only big difference. But it means:

- Really portable TV sets—run by batteries.
- Radio and TV tubes that don't burn out, never have to be replaced.
- Lights, like fluorescents, but brighter and much longer-lasting.
- On-the-wall picture tubes for TV, very brilliant and as big as you want.
- Good portable radios much cheaper than present ones.
- A super-powerful amplifier that will make radios and TV sets perform far better with fewer tubes.

Coldness counts. The hot parts of present tubes burn out, like filaments in light bulbs. This is what usually happens when a tube goes dead in your radio or TV set. Cold tubes should last indefinitely; one experimental model is still going strong after operating continuously for a year and a half.

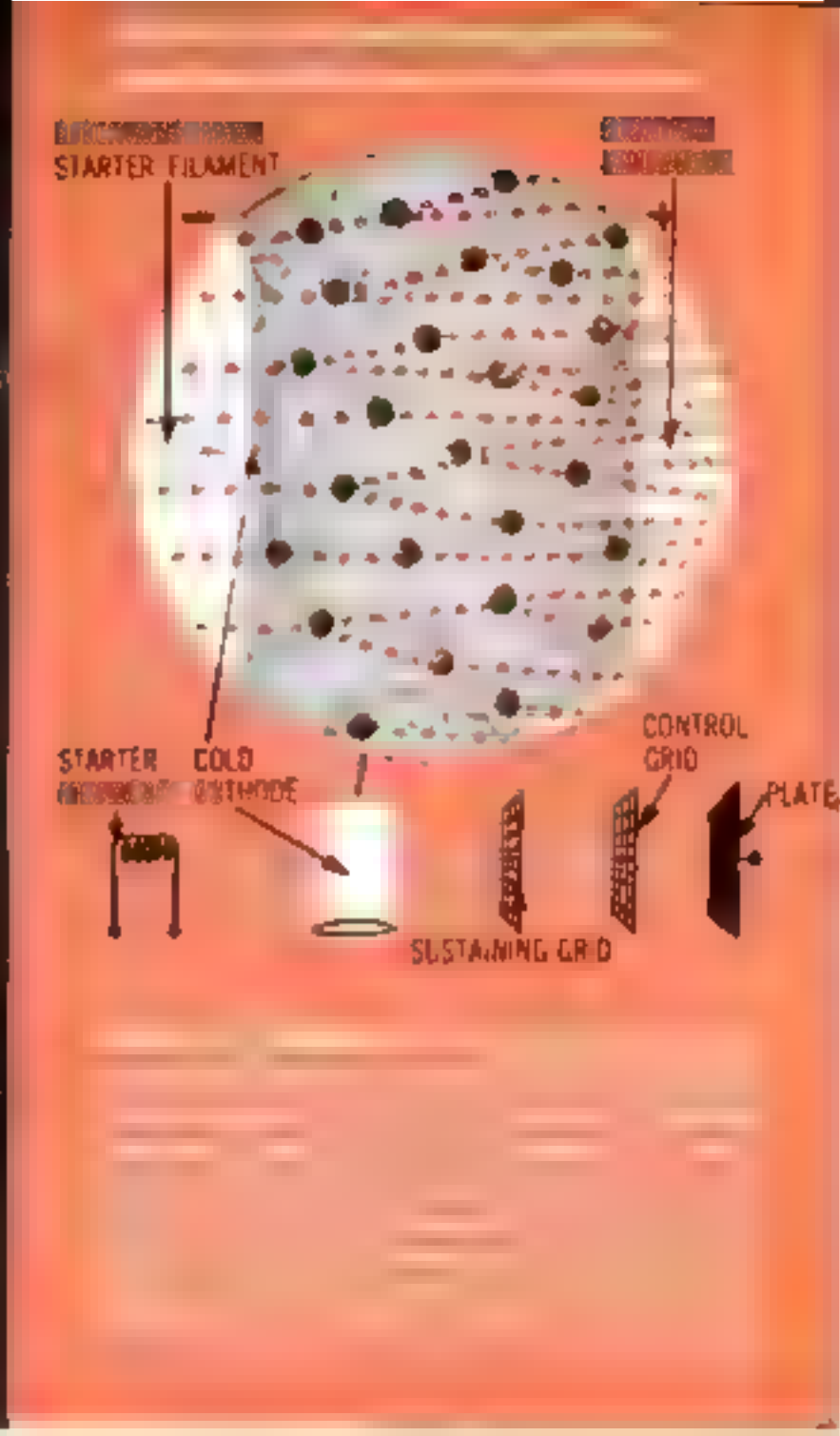
Just heating the hot parts of an ordinary tube takes most of the electricity that the tube needs. Cold tubes use only a tenth as much power and operate happily on small batteries. Their advantage over transistors is that they are easy to mass-produce.

The cold tubes clear both the bottlenecks that have been holding up truly portable TV:

1. Transistors for TV's high frequencies are difficult to make. High-frequency tubes are not.

2. Picture tubes (you can't make them out of transistors) draw a lot of power, requiring expensive batteries. You can make picture tubes out of the new cold type, and their appetites are slim.

Cold tubes don't have to warm up, naturally, so they start working quickly (¼ second or so) and can be made to start almost instantaneously (.001 second) by holding them ready with a trickle



new tube, which uses less power, starts quickly and should last indefinitely. Both tubes above are audio amplifiers with their outside plates removed so you can see the cathodes.

of "keep-alive" current—only .00001 ampere. Quick starting is just a convenience in radios and TVs, but is important to gadgets like garage-door openers.

They're ready to go. The first of these handy vials of electrons was demonstrated only this winter. But Tung-Sol Electric, the Newark, N.J., tube and lamp maker that developed them from a Signal Corps discovery, said mass production could begin tomorrow, on its regular machines—it's that easy. Actually, they won't be made in quantity until next year, when enough different types to outfit a whole radio will be ready. And then the military has first call for use in satellites and computers.

Kicking electrons loose. The new tubes, instead of boiling electrons out of a cathode with heat, pull the electrons off with electric force. The first models use some heat (from a filament) just for starting, but even that isn't essential—hitting the cathode with other electrons, or shining a light on it, will also start it spewing electrons.

Dr. Dietrich Dobischek, the thin-faced Signal Corps scientist who stumbled on the cold tubes (yes, the discovery was an accident, but you'd have to be as expert as Dr. Dobischek to know when you've had this kind of accident), explains their operation this way:

Energy from outside—a flying electron, a ray of light or heat—knocks loose an electron inside the cathode (a thin, porous layer of magnesium oxide, the stuff in milk of magnesia). This freed electron starts an avalanche inside the material, knocking loose several electrons, each of which knocks loose several more. Many fly out of the surface of the cathode.

The surface loses so many electrons, which are negative electricity, that it becomes positively charged. This positive charge on the surface pulls more electrons from inside the cathode material (unlike charges attract, remember). So the avalanches of electrons continue, and

INVENTOR: Dr. Dietrich Dobischek of Signal Corps research lab at Fort Monmouth, N. J., discovered the everlasting tube "accidentally" while working on super-amplifier tube.

the cathode continues to emit a stream of electrons.

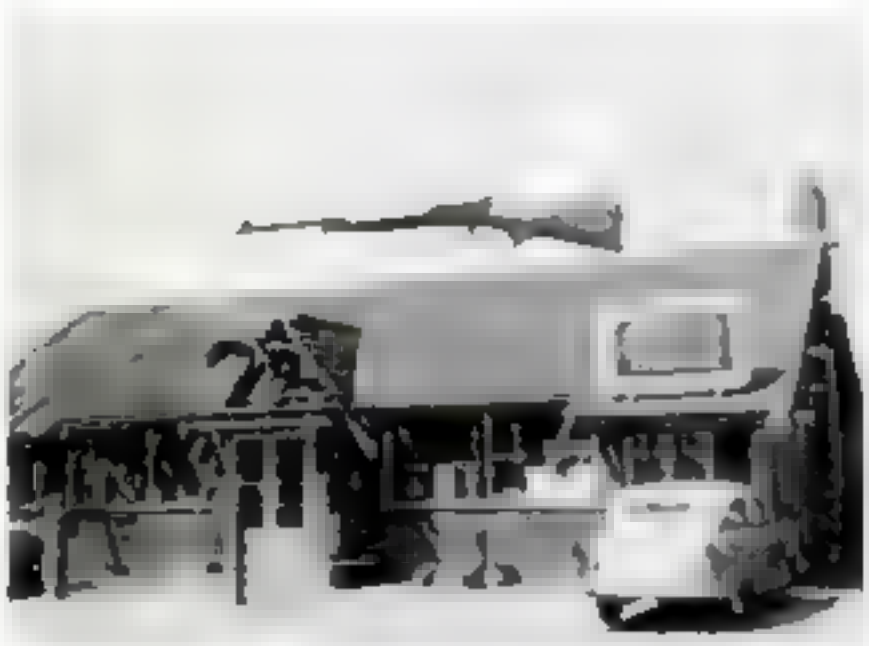
From that point on, the cold tube works like any other. But the fact that it needs no heat fits it for several new kinds of uses:

Flat picture tubes. The cathode, now unheated, can be spread out flat, as big as the picture area, then placed close behind the phosphor screen that glows with the picture. A wire grid near the cathode would make it emit electrons in the shape of the picture. The stumbling block, which keeps on-the-wall TV in the dream stage, is control of that grid.

Lamps. These would be tubes coated with whitish phosphor. A long cathode running down the center would emit electrons that make the phosphor give off light.

Super amplifier. The cold cathode also looks like the missing piece to the puzzle of the secondary-emission amplifier, an always-promising but never-quite-successful idea that has been kicking around the labs for years. It is a vacuum tube with two (or more) cathodes, the electrons from the first triggering an electron avalanche from the second. The trouble has been that parts of the hot first cathode evaporated off onto the second and "poisoned" it, a difficulty which obviously is eliminated by cold cathodes.

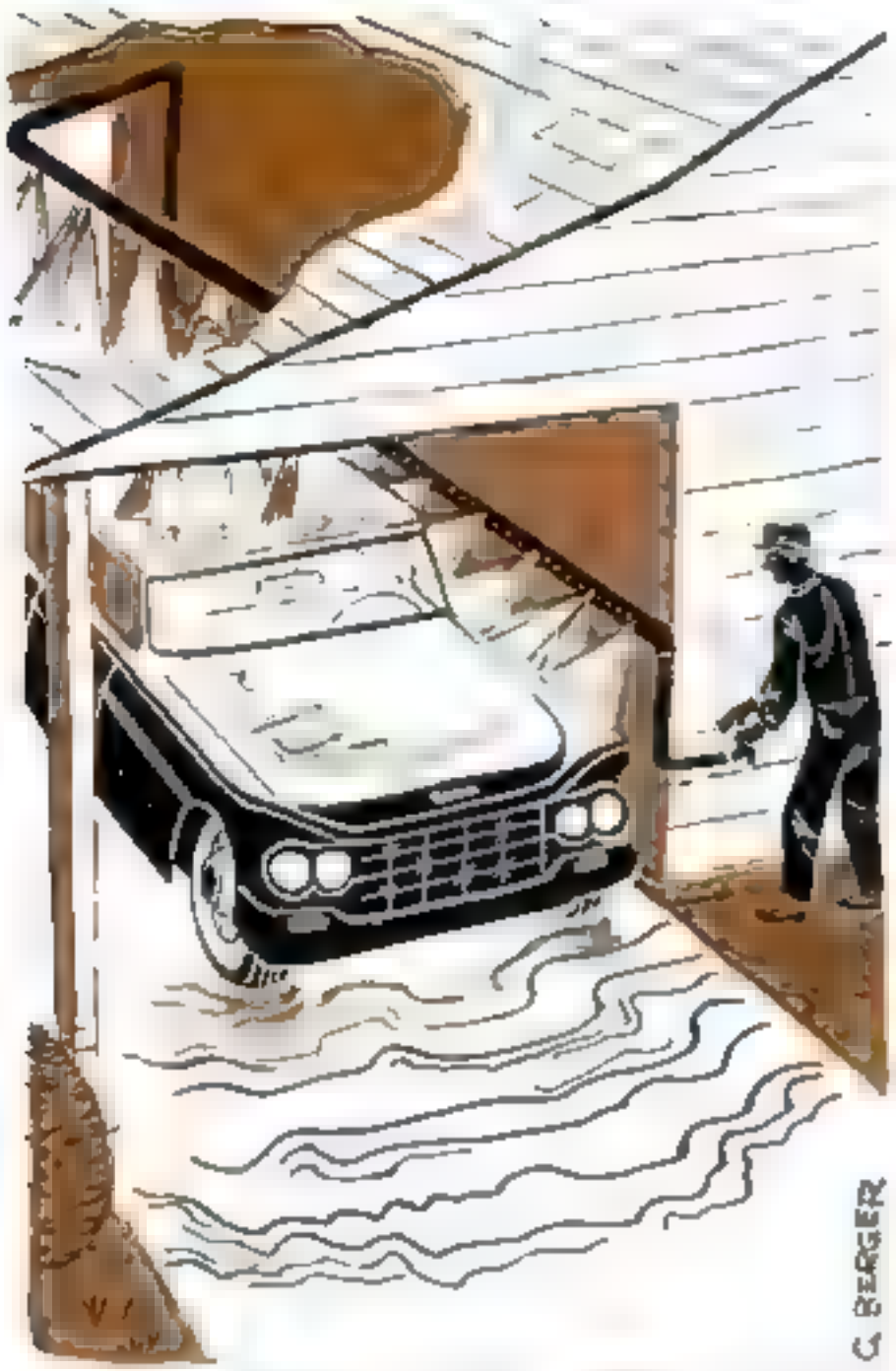
The big advantage of this super tube is not simply that it can do the work of four or even 16 present amplifiers (as it can). If you gang ordinary amplifiers, each tube adds its own noise to the output. (Noise is the natural variation of electron flow that you see as "snow" in a TV picture or hear as a hiss in radio sound.) The super tube multiplies the amplification without multiplying the noise. This means a sharper TV picture and clearer radio program as well as a big saving in the number of tubes that sets need.—*Martin Mann.*



BIG GUN. This oversize replica of a Winchester rifle calls attention to a new sports shop near Burlington, Vt. Made of sheet metal to exact scale by a local tinsmith, it's 32 feet long from muzzle to butt and mounted on iron pipes.

MULTI-JET TRAINER. The four-engine swept-wing jet above was developed by McDonnell for the Air Force for use as a low-cost trainer and transport. It has a range of 2,500 miles at 550-m.p.h. cruise speed, performs like a big bomber.

"I'd like to see them make..."



A DUAL-PURPOSE CARPORT. With oversized plastic sprinkler hose on the enclosed side and along the roof, the carport could double as a home car wash.—*Tom Rizzo, Brooklyn, N. Y.*

A LAWN ROLLER WITH TWO OPENINGS. A drain on one side and an air intake on the other, both with plugs, would make emptying a roller faster and easier.—*Joseph P. Izzo, Providence.*

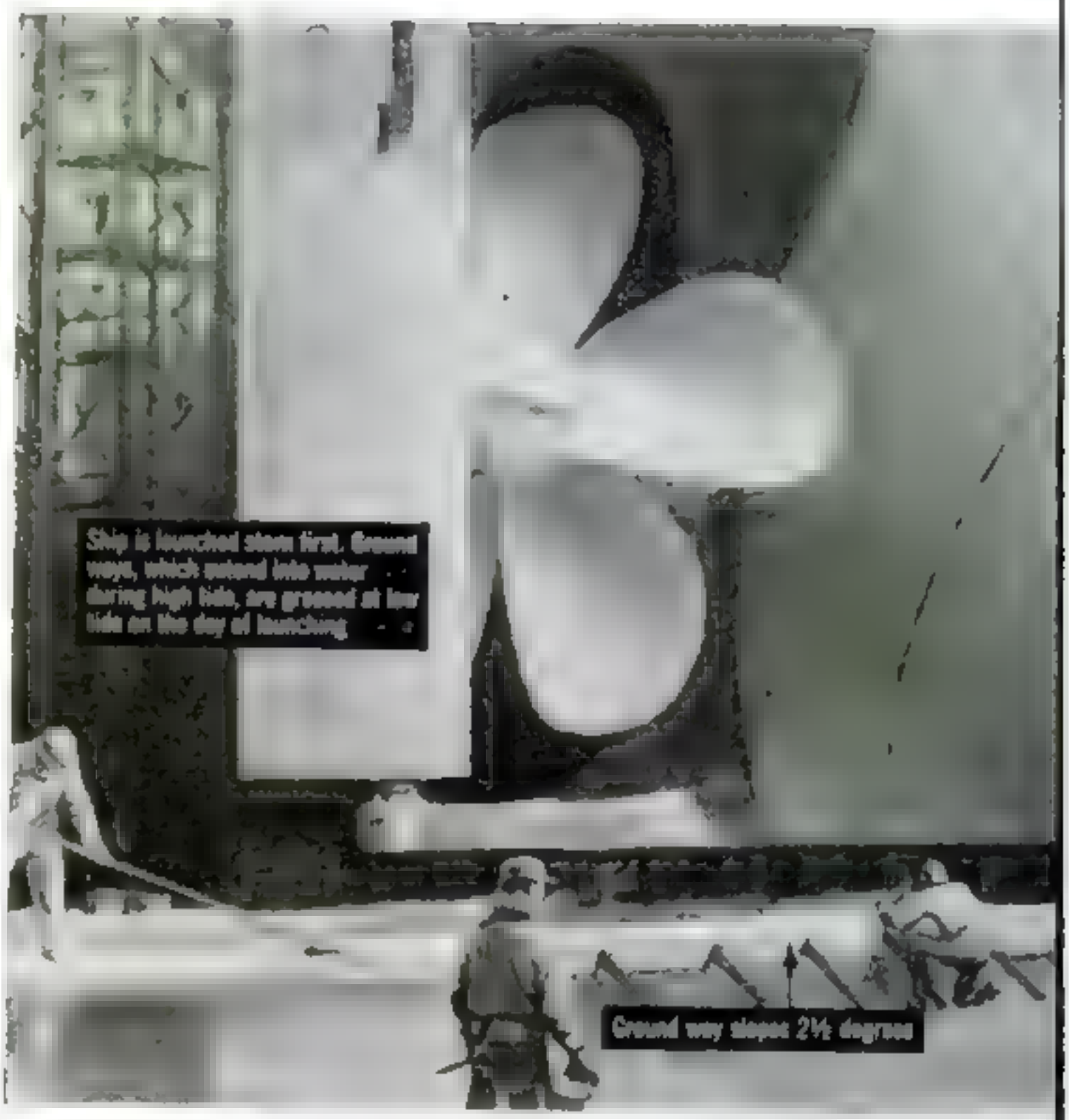
A TUBULAR DIP STICK of clear plastic. You'd use it like a pipette to check oil level: Insert it, put a thumb over the top and lift out a slug of oil for an easy reading.—*A. P. Connor, Baltimore.*

A TOOLBOX WITH A SLIDING HANDLE. To balance an off-center load, you could move the handle along tracks on the top and lock it in the new position.—*Joe Burke, Bay Port, Mich.*

ALUMINUM-RIBBED BOATS IN KIT FORM. The metal ribs could be bolted to plywood, eliminating screws that so frequently pull out or break off.—*K. N. Crosbier, Poughkeepsie, N. Y.*

Everyone has his own pet idea of a gadget that he would like to see in general use. The five ideas illustrated above were suggested by POPULAR SCIENCE readers. What's yours? We will pay $5 for each one published. Please use Government postcards only. Write name and address clearly. Contributions cannot be acknowledged or returned.

The Delicate Job of Launching a Ship



Shift from construction supports to launching ways is the big job

1

When a ship slides down the ways, it's hats off for the men who did the job. It takes brains, brawn—and oceans of grease

By Herbert O. Johansen

AT 4:10 in the afternoon, a bottle of champagne was broken over the bow of the 30,000-ton Mobil Aero at the Sun Shipbuilding and Dry Dock Co., Chester, Pa. The great hull slid slowly and majestically down into the Delaware River.

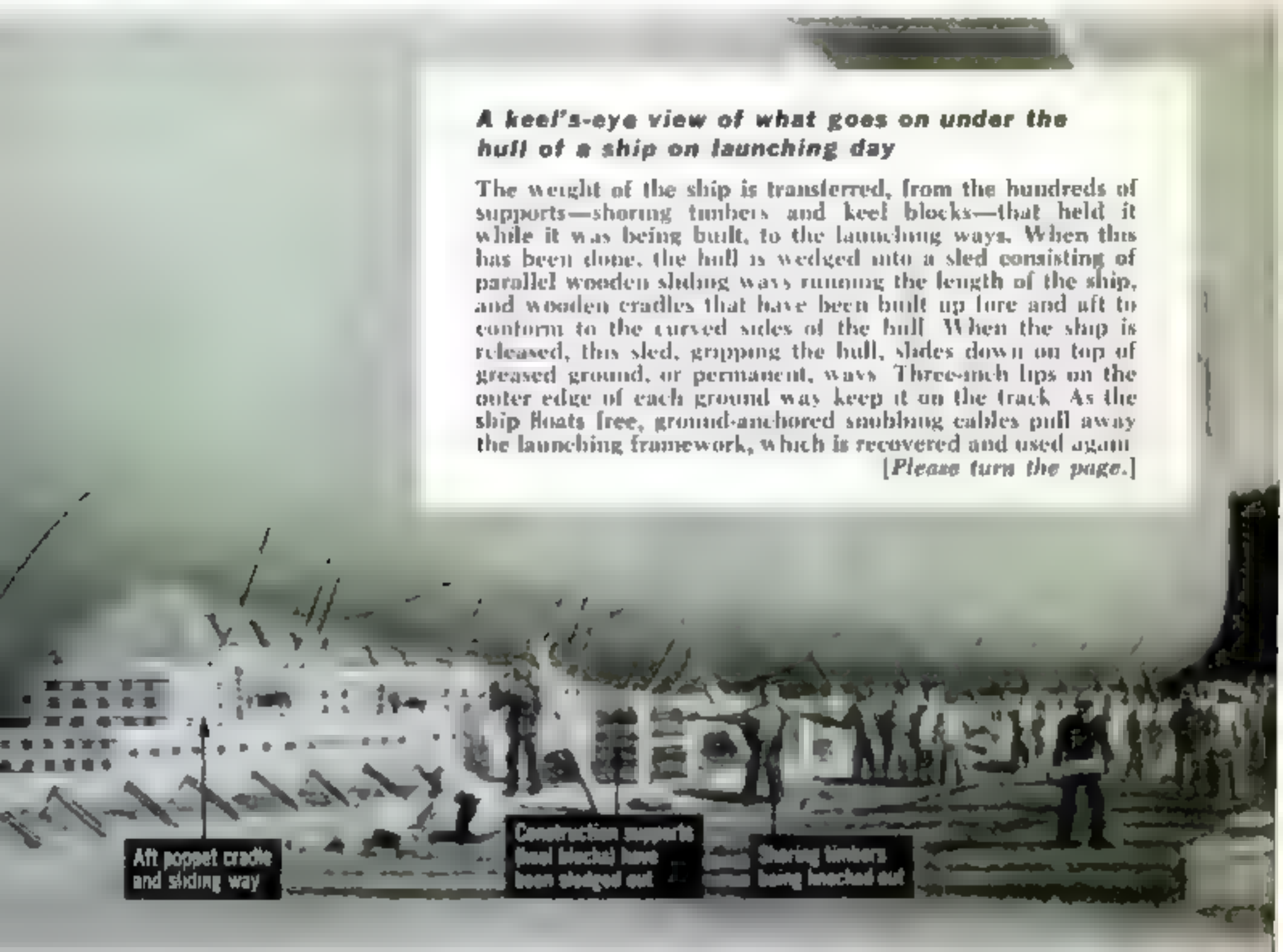
Below the flag-draped sponsor's platform, along each side of the more-than 600-foot stretch to the river's edge, stood a hundred-odd weary men in work clothes, many with their safety helmets and hats doffed, a silent prayer on their lips. They knew that it takes more than a bottle of sparkling wine to launch a big ship. That dramatic moment was the payoff for an agony of work and planning.

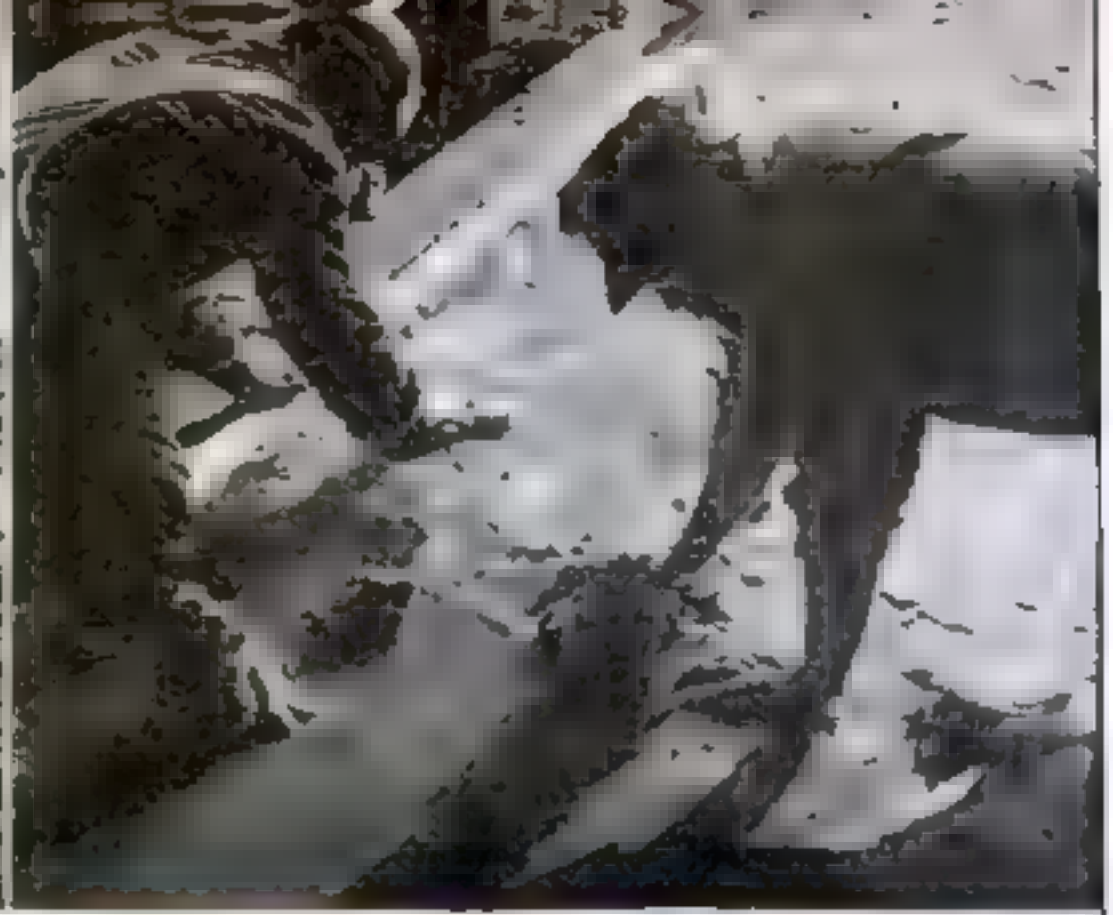
Preparations began a month before when the launching ways were installed under the hull, between construction sup-

A keel's-eye view of what goes on under the hull of a ship on launching day

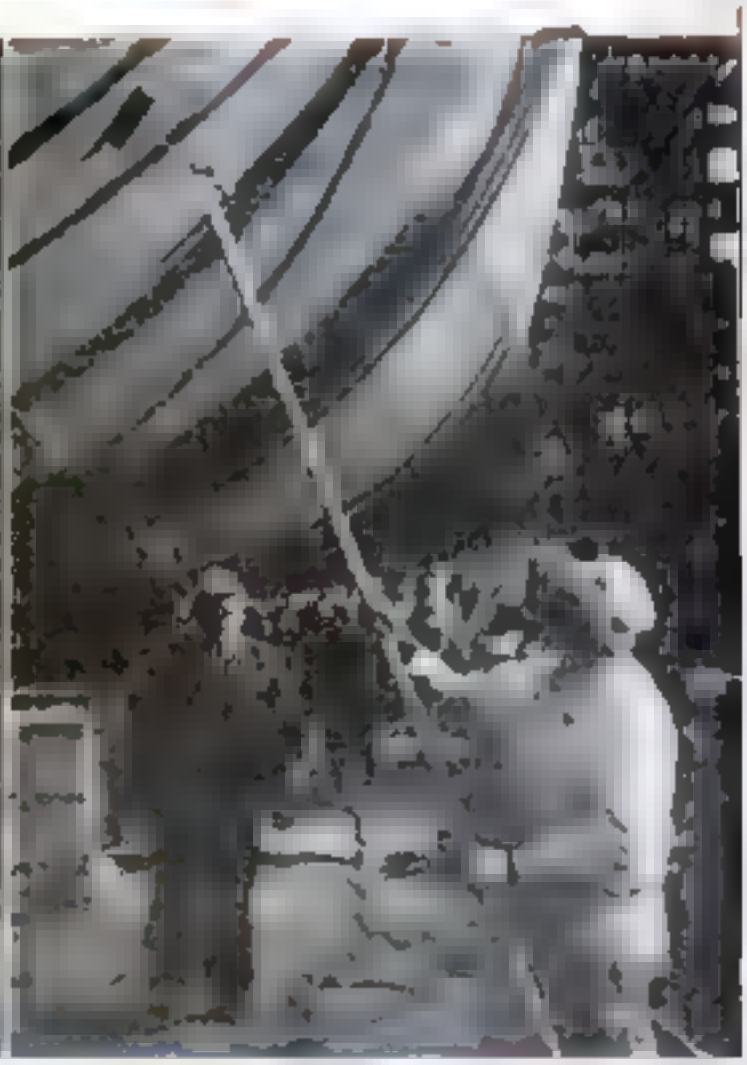
The weight of the ship is transferred, from the hundreds of supports—shoring timbers and keel blocks—that held it while it was being built, to the launching ways. When this has been done, the hull is wedged into a sled consisting of parallel wooden sliding ways running the length of the ship, and wooden cradles that have been built up fore and aft to conform to the curved sides of the hull. When the ship is released, this sled, gripping the hull, slides down on top of greased ground, or permanent, ways. Three-inch lips on the outer edge of each ground way keep it on the track. As the ship floats free, ground-anchored snubbing cables pull away the launching framework, which is recovered and used again.

[*Please turn the page.*]





1 AS THE TIDE EBBS LOW, about seven hours before the slack of high tide when the ship will be launched, ground ways that extend into the river are greased. On the wood planks previously dried by gas torches, a base coat of hot grease is poured from buckets and spread with brooms. Over this a slip coat of lighter grease is applied by hand (above, right). All launching-day activities are carried on simultaneously on both sides of the ship's hull.



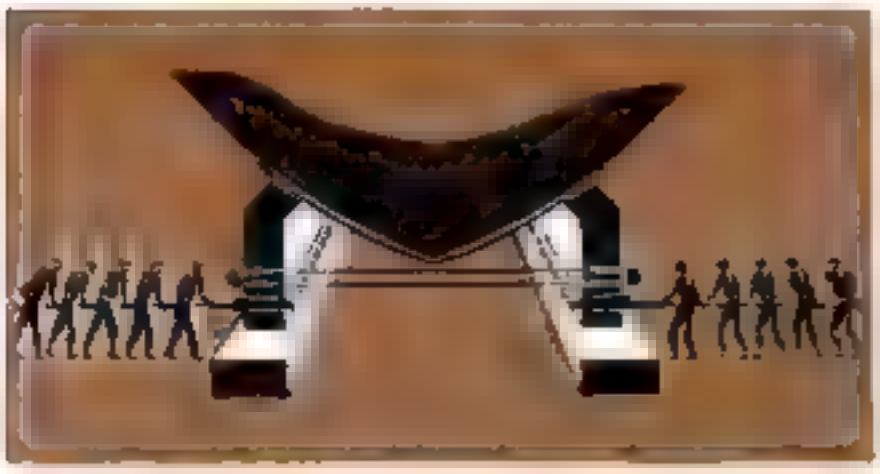
3 SHORING TIMBERS are another construction support. To remove these, welded metal chip plates at the hull end are burned off by acetylene torch. Some timbers can then be sledged out; stubborn ones call for battering rams. After chipping hammers have removed weld residue (not shown), scars are covered by three quick-drying primer coats and one red finish coat. Paint rollers do the job quickly.

2 AT THE SAME TIME, work starts on knocking free hundreds of under-hull construction supports that have taken the weight of the ship during building. These are called keel blocks. Here a tie bolt holding together the top unit of a keel block is loosened (left), then sledged out (right). Construction supports are knocked out according to a precise timetable so that the 18,000,000-pound weight of the hull is transferred evenly to the launching ways.

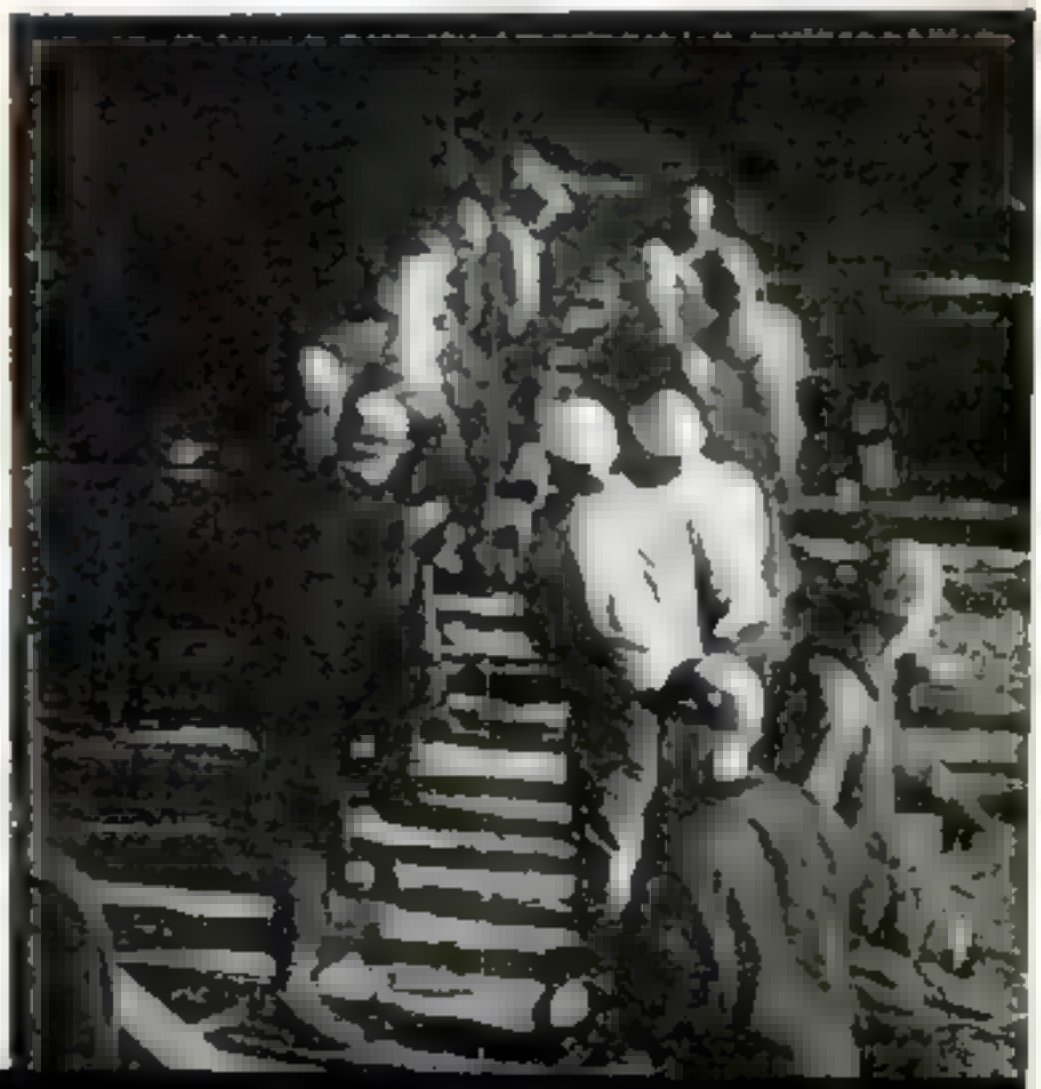
ports. The hull of a ship never touches the fixed ground ways, made of parallel planked tracks, underneath. Instead, it rides on a sled—sliding ways with wooden cradles (poppets) fore and aft—that on launching day is wedged to grip the hull tightly.

The ground ways are made of heavy white oak and pine in 40-foot lengths, 53 inches wide and 14 inches thick. They are bolted together to form tracks on either side of the keel. These ways are dried with gas torches and then coated with hot, liquid grease. This hardens to a five-eighth-inch thickness. Over it is put a slip coat of lighter grease that stays soft.

Then the sliding ways, 49 inches wide, 18 inches thick, and also in 40-foot lengths, are laid on top of the ground ways. Wedges, 24 inches apart, are inserted between the sliding ways and the bottom of the hull. Just before launching these are rammed in.



4 AS THE WEIGHT IS TRANSFERRED from the construction supports to the launching ways, 15-man ramming crews hammer in wedges that tighten the sliding ways and the fore and aft poppet cradles to the hull. These form a double-runner sled on which the ship will go down the ground ways. [*Please turn the page.*]



When the ship slides down the greased ways, its hull is snugly cradled in a launching sled

5 **LAST CONSTRUCTION SUPPORT** has been knocked out, leaving only "trip" shores amidships (heavy timber set at angle in photo left). Notched into the upper half of the sliding ways, they act as parking brakes to restrain the now almost-free hull. At five minutes before launching, ramming gangs knock out steel pins that hold the trip shores, which drop (right). Now only two steel plates at the bow keep the ship from sliding down the ways.

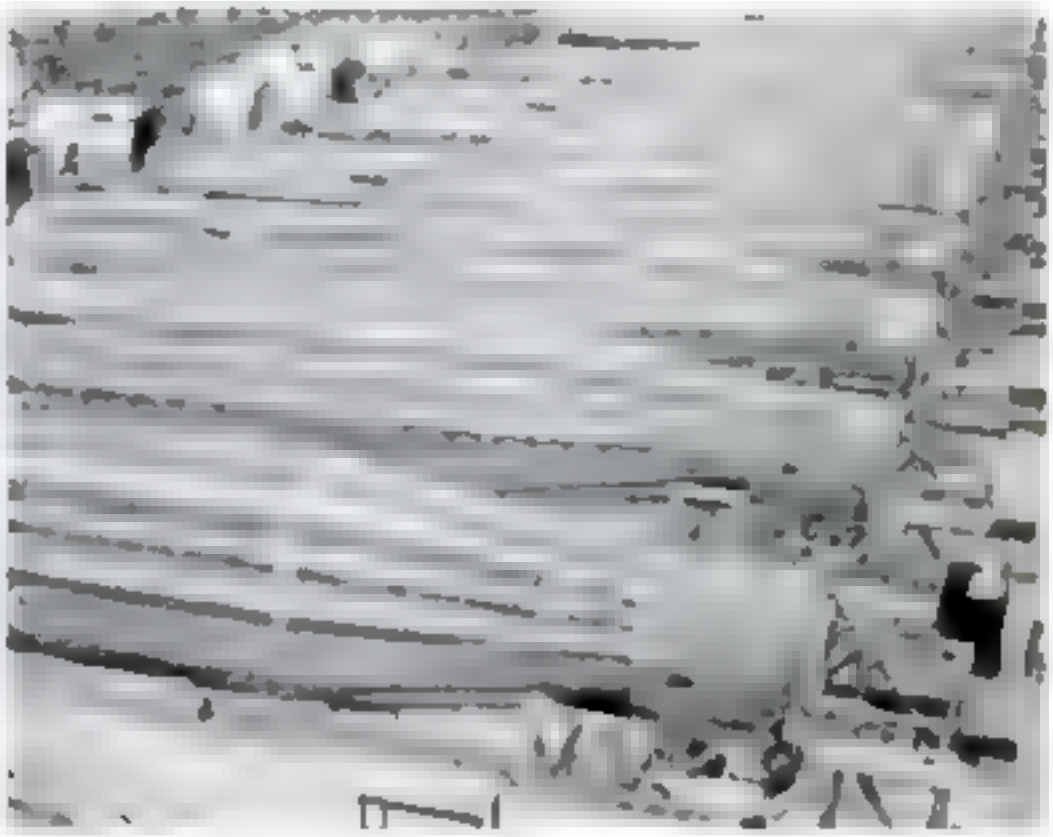
6 **LAUNCHING SLED** gripping the hull is held only by two steel cut-off plates, which are anchored in concrete. Torch-burning of the plates by teams at either side of the bow is split-second timed so that both break off at the same instant. The ship is launched. END

Supertankers Are Ocean Giants

RIVALING in size the largest ocean liners afloat are the new supertankers that carry crude oil from oil fields and pipe-line terminals throughout the world to refineries. Although the 641-foot-long Mobil Aero, newest ship to join the Socony Mobil fleet, is not the largest of these, it is a $10,000 000 giant. With a cargo capacity of 30,000 tons, it can take on 251,000 barrels of oil. Its speed of 17.5 knots (20 m.p.h.) is greater than that of standard tankers with less than half the cargo capacity. Only three additional crew members are needed, for a total of 58.

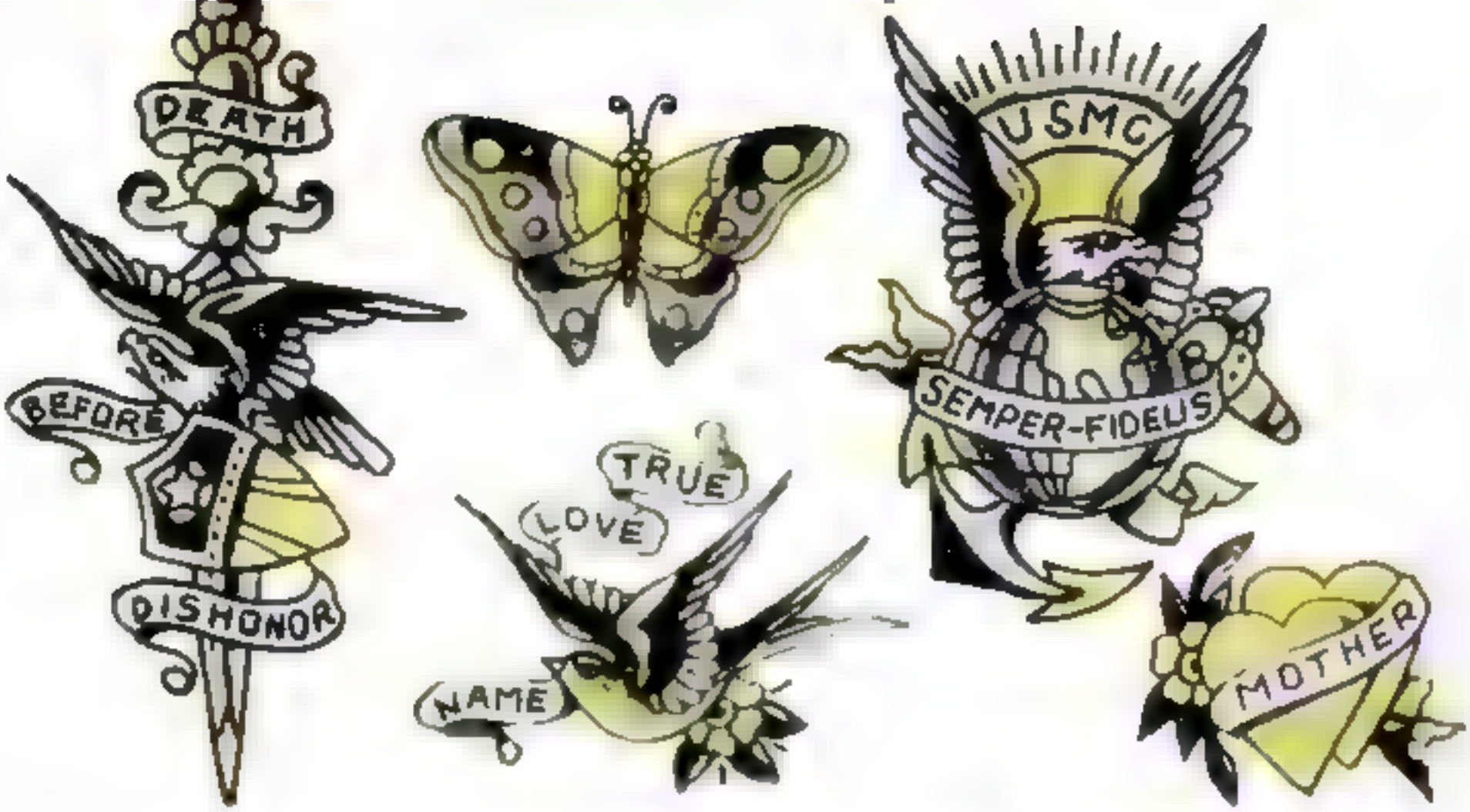
"AIRBORNE" GAS STATION. Built by an ex-Air Force man who liked the atmosphere of a cockpit, this masonry version of a plane in Cincinnati looks as if it is poised for a takeoff. It first carried full wings, but they were stubbed when they proved low bridge for big trucks.

CAR-TOP BED. Two can sleep in comfort in the double bed atop the car above without the bother of setting up a tent at camping stops. It folds flat and stays on its perch for highway travel. It's the invention of a British trailer dealer.



ATLAS PRODUCTION LINE. Air Force intercontinental ballistic missiles are assembled here before delivery to test sites and operational squadrons. The 75-foot stainless-steel rockets rest in test racks at Convair's San Diego plant.

HALFWAY HOUSE. At Oberwesel, Germany, when highway builders found the house at right in the way of a new roadbed, they lopped off half. The rest was left standing for temporary lodgings while the family hunted a new home



How Tattoos Help

Unique file of more than 90,000 designs often leads Los Angeles police to decorated criminals in a hurry

By Sam Lynch

THE other day, a motorist near San Francisco gave a hitchhiker a lift —only to have the ingrate take his car and money at knifepoint.

The police soon found the car abandoned. But the chances of capturing the culprit were slim, they pointed out. All they had was a general description, which would fit innumerable people, and the curious fact, noted by the motorist, that the hitchhiker had a tattoo of Felix the Cat on his right wrist.

That tattoo, as it turned out, was quite enough to trap the criminal.

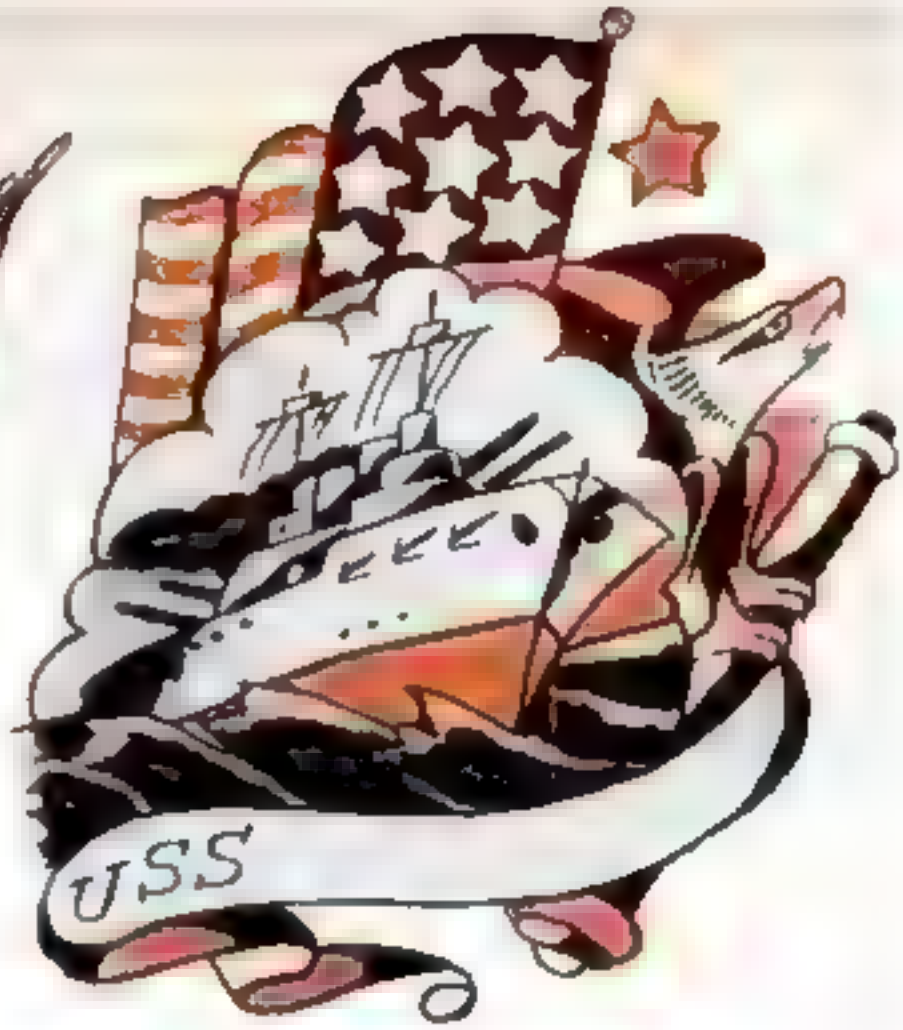
The San Francisco police had sent out an all-points teletype containing all the information they had about the hitchhiker. One of the points notified at once was Los Angeles, whose police department has a most remarkable tattoo file. No other law-enforcement agency, except possibly the FBI, is believed to have anything like it in size and scope. In the file, every tattoo found on the more than 200,000 people arrested by Los Angeles police each year is described and indexed, along with all available information about the wearer. The file also lists tattoos mentioned in wanted-person bulletins from other parts of the nation.

The ability of this file to identify a criminal promptly—if he or she has a record and a tattoo—can be amazing.

It outdid itself in the speed with which it helped nab that hitchhiker. For there in the file were a description of his tattoo and its location, a picture of him, evidence that he had a criminal record, and his address. Almost too patly, he lived in Los Angeles! So the police were waiting for him when he got home.

On another occasion, a Los Angeles store detective caught sight of a shoplifter at work. The thief managed to slip away, but not before the detective had spotted a tattooed star on the back of the man's left hand. The detective telephoned the police. They checked their tattoo file, and shortly arrived at the store with photographs of several petty thieves, each sporting this particular tattoo. The store detective identified one as the shoplifter, whereupon the police drove to the latter's house and arrested him.

L-O-V-E. It is not usually that easy. More typical was the case in which Los



Cops Catch Crooks

Angeles and Mexican police were harassed by a ring of auto thieves who were stealing cars in Southern California and driving them into Mexico to sell. Finally, the Mexican police came up with a clue. The ringleader had L-O-V-E tattooed across four fingers of each hand, one letter to a finger.

This is a fairly common tattoo, and the L. A. file produced a dozen suspects. Gradually, the police eliminated all but one. He was hard to find, but when the police caught up with him, he turned out to be their man. Furthermore, through him the entire ring was apprehended.

The Los Angeles police began their extraordinary file 10 years ago. Today it contains more than 90,000 index cards. Each lists a tattoo and its location on the body of the wearer, whose name and brief description are given. The card also lists the number of a pertinent "criminal folder," in which is kept a more detailed description of the tattooed person, with his police record, photographs, fingerprints, known aliases, addresses, haunts, associates, relatives, etc.

From Anchor to Zoo. The index cards are filed under Designs, Words and Letters, and Numbers. Designs run from Anchor to Zoo. (One man has an entire menagerie pricked into his skin!)

Under each heading, the cards are filed by location, from Scalp to Toe and including the strangest places.

Since there are often scores and even hundreds of cards under the headings of certain popular designs, such as Anchors or Flags, and commonplace locations, the tattoo file has lately had to be divided into four racial groups, subdivided according to sex and even height.

But the speed with which this detailed index can make an identification is sometimes uncanny.

A convivial man the other night re-

PICKING UP THE TRAIL of a wanted man in Los Angeles frequently begins here at the Police Department's mammoth tattoo file. Pneumatic tubes (rear) shoot data to detective divisions.

Indiscreet tattoos like these, which are quite common, led to the capture of a ring of thieves.

ported dejectedly to the Los Angeles police that he had picked up a friendly girl at a bar, made the rounds with her and later found that his wallet was missing. The police offered little consolation—until he mentioned that she had had GYPSY tattooed at the base of her throat. The officer taking the report asked the man to wait while he checked the tattoo file. Very soon, the cop returned with a photograph. Was this, he asked the man, the bar fly who had stung him? The astonished victim said it was indeed. The police then drove around to the address given on her file card, and nabbed her. Within 30 minutes, the man had his wallet back and the girl was in jail.

While such a case dramatically illustrates the potential of the tattoo file, the police emphasize that rarely does the file solve a case all by itself.

Thus, when a gunman held up a Los Angeles bar, and the bartender noted the initials RV tattooed on the hand that held the gun, the file quickly identified the criminal. Finding him, however, was something else. Then, one day a long time afterward, a local traffic cop stopped a speeding motorist. There were the tattooed initials RV on the speedster's right hand! The cop, who, like the rest of the force, had been told to be on the watch for this tattoo, attempted to make an arrest. The gunman bolted. There was an exchange of shots, but the fugitive escaped. With his driving license and the license number of his car as additional clues, however, the police soon rounded him up.

The tattling tattoo. In another instance, a man was arrested for passing bad checks. He was known to have a woman accomplice, but the police didn't know who she was until they found the name CONNIE tattooed on the man. The tattoo file then tattled on Connie and led to her apprehension.

Tattoos are a form of exhibitionism, psychologists say, and experiences of the Los Angeles police support this opinion. For instance, a youthful purse snatcher in that city was so proud of a tattooed rattlesnake on his left arm that he wore short-sleeved shirts—which, thanks to the file, shortened his criminal career.

Certain tattoos also apparently reflect a psychotic quirk. A man with a long criminal record is listed in the tattoo file as having C-R-I-M-E imprinted across the thumb and fingers of his right hand. SIN beams from the Adam's apple of a juvenile delinquent. A sex offender advertises BORN TO LOVE on his chest.

Other tattoos have a distinctly ironic twist. LIBERTY OR DEATH is tattooed indelibly on many a man living behind bars. DEATH BEFORE DISHONOR is a tattooed standard that thousands of individuals listed in the file have obviously failed to meet.

Ships, eagles, prancing steeds. The file catalogues many masterpieces of the tattooer's art. A full-rigged schooner with the name Flying Cloud, surrounded

Tattoos Have Been Popular Since Man's Earliest Days

TATTOOING—pricking a design into the skin to make the decoration more permanent—dates back at least 6,000 years, anthropologists say.

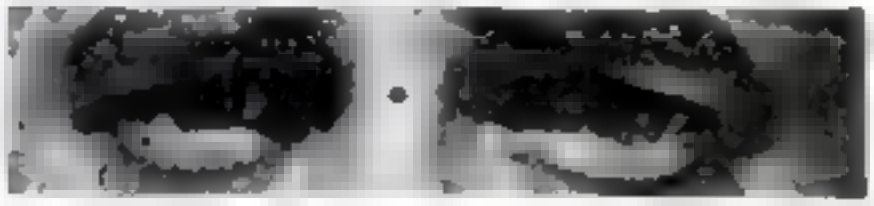
A thorn and soot were the original tattoo needle and dye. Soot and red-clay dust are still widely used for coloring tattoos, though the better tattoo "artists" pride themselves on secret dyes. Only the very best tattooers offer more than two or three colors, however. The steel needle has replaced the thorn, and electric propulsion of the needle (or of groups of needles for coloring large expanses of skin) was developed late in the 19th century. Finer needles and better electrical control of speed today make tattooing sometimes al-

by mermaids, sails across a felon's chest. On the back of a twice-convicted thief, a Raphaelic Virgin Mary is watched over by hovering angels. The skin of a forger is the canvas for a foot-high cross with an eagle perched on top of it and a ship sailing through its center. Across the epidermis of several lawbreakers, a battleship plows through an inky sea with the words Sailor's Grave emblazoned below. On the broad chest of a Texas renegade prance four beautiful steeds, their manes flowing. Eagles, black panthers in pairs, leaping tigers, peacocks with brilliantly spread tails, and Indians spectacularly feathered and colored are popular examples of tattoo art listed in the Los Angeles police file.

Tattoos on women criminals are more common than might be supposed, but less gaudy than those that men favor. A tattooed necklace or bracelet is a common female choice

Dots that say "I belong." A tiny dot or cross on the web of a hand, or on a cheek or forehead, or beneath an eye are mysterious tattoos whose meaning the Los Angeles police have never discovered. They are often found on youths who are members of gangs. The marks apparently are not related to any particular gang, and the police believe they may simply advertise to one and all that "I belong."

Los Angeles police are grateful to individuals who have had identifying Social Security or military serial numbers tattooed on their bodies. Thousands are listed in their file! Occasionally, too, they find a prison number tattooed on a man.



A MYSTIFYING MARK favored by members of youthful gangs, a tattooed dot between the eyes has been the undoing of many a delinquent.

Chief William H. Parker, of the Los Angeles Police Department, points out that the tattoo file has also proved valuable in quickly identifying unknown dead or unconscious injured persons. It has even helped find missing ones.

Once it worked almost too well. A local woman reported that her husband had vanished. Under "identifying marks," she listed several tattoos. This led to a search of the file, where it was found that the same tattoos were listed for a man of identical description but different name and address. His criminal folder revealed that he had been arrested a couple of days before for a sex offense and was now in jail. A trip to jail verified that this man of another name was the "missing" husband. He had given the police a false name and address in an attempt to hide his shame from his wife. END

One Trouble With Tattoos: How to Get Rid of Them?

FOR all modern surgery and science the honest tattooer and surgeon will tell you, there is no way to remove most tattoos without leaving some blemish or scar. Tattoo removers pride themselves on secret bleaches that will destroy most and sometimes all of the color—but also bleach the natural coloring of the skin. Tattoo dyes are impressed so deeply that sandpapering **the skin makes no impression on them. Surgeons do cut out tattoos, either covering the removed area with a skin graft or, when possible, gathering and stitching the two sides of the incision so that they will grow together. But these methods leave scars of some sort. Not infrequently, a person who has had a tattoo removed returns to the tattooer—to have another design pricked over the scar left from the removal of the first one!**

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most painless. But the hand needle is still used exclusively in some places, and by the best tattooers everywhere for fine details.

Sailors are especially fond of tattoos, but even European monarchs, including the late King George V of England and the last German Kaiser, have shared the yen. Odd designs chosen have ranged from family portraits, copied from photos, to wills. Movie stars and society matrons have been among the clients of Lee Roy Minugh of Los Angeles, a noted tattooer. People of all classes come to Minugh to be tattooed for cosmetic reasons—to hide scars and blemishes, emphasize eyebrows or imitate hair on a balding scalp. Some men have come to him for a quick "mustache," which changes their appearance immediately.

"I ask no questions—like a doctor," Minugh says.

Houseboat of the future can be expanded as you need more space by adding on extra sections. Each unit is 7′ by 11′, can be either enclosed cabin or retractable-roof sundeck. Designed by Brooks Stevens for Evinrude, the pontoon craft may be adopted by boat builders soon.

Convertible switches from fast outboard to racing sailer in minutes. The 18½′ Swedish import has a bunk, sells for about $2,000 from Duncan Sutphen, 342 Madison Ave., NYC.

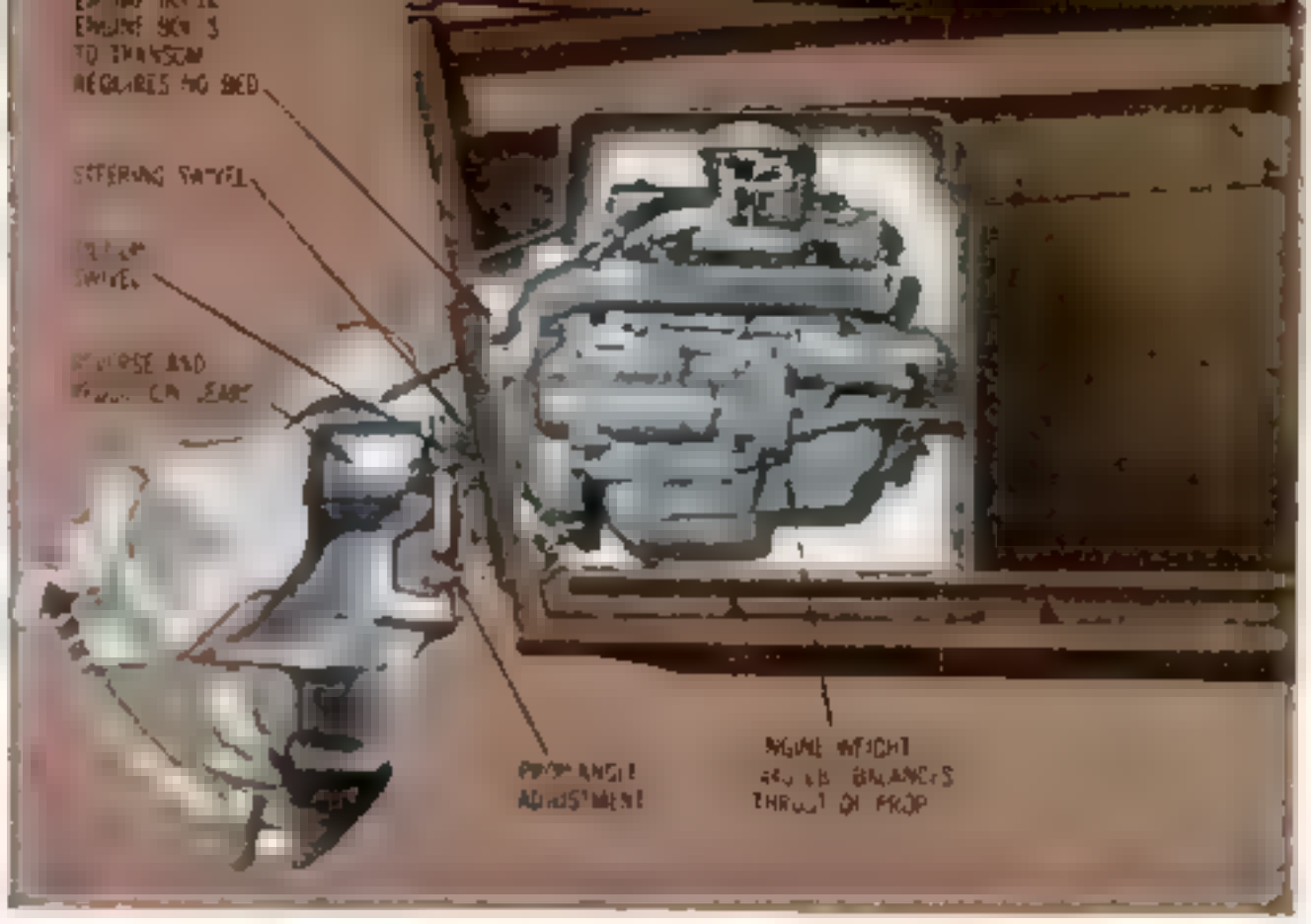
What's New in Boating

Portable helm lets you steer from any point in a boat while fishing or navigating tricky waters. Hand-held switch (arrow) operates a tiny reversible motor linked to a steering arm. Hupp Corp., 7450 Melville Ave., Detroit, sells it for about $70.

Dream boats run on, under or out of water

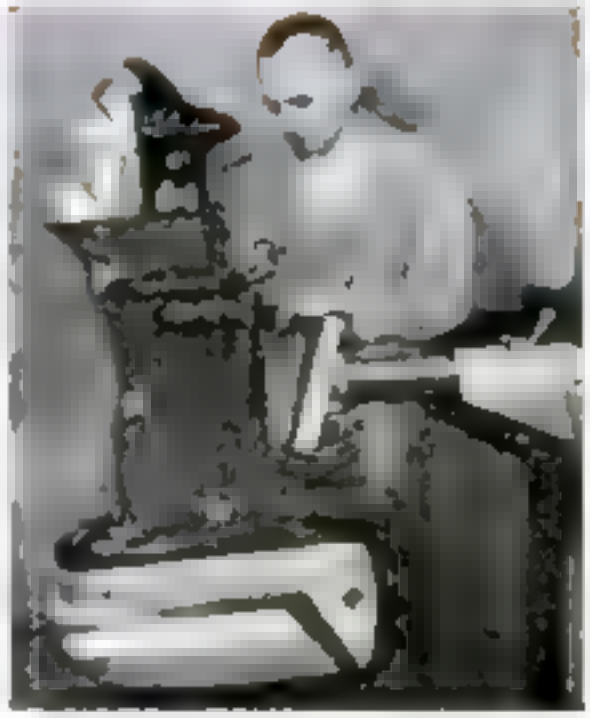
Fantastic new thrills may be on the way, according to dream-planners at Scott Outboard. One-man sub (near right) runs on air-driven props recharged through snorkel tubes—you wouldn't even have to come up to refuel. At center, cruiser would back up to shore and blow out inflatable living quarters for the whole family. Amphibious runabout (far right) rolls on land on retracting wheels.

New inboard-outboard pairs a Swedish Volvo engine with a unique tilting prop. The prop swivels right to left for steering, up for beaching and hauling. The 80-hp., four-cyl. engine is said to give outboard speed on as little as one-third fuel. For hulls 16′ to 30′, it sells for $1,385 from Volvo Import, Englewood Cliffs, N. J.

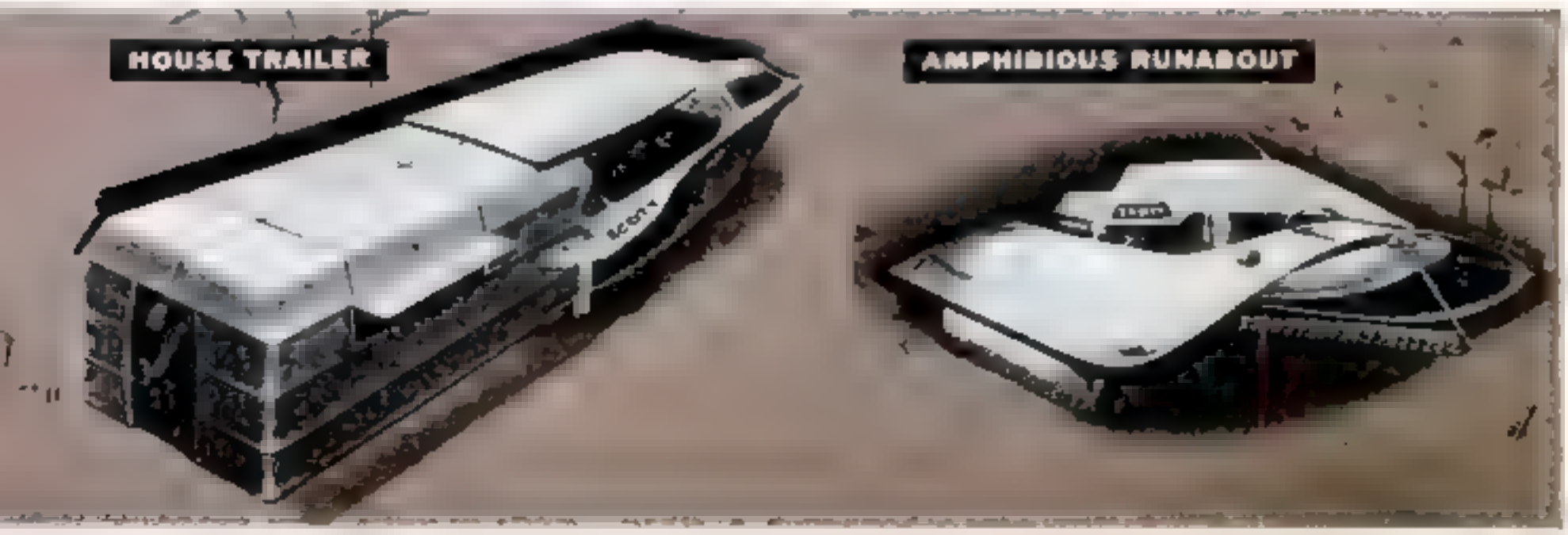


Variable-pitch prop for outboards lets you "dial" best of seven blade angles for racing, skiing, other power demands. Price is $27.75 from Lesnor Maehr Marine, Floral Park, N.Y.

Clamp-on wheel makes it easy for one person to roll a boat to water. L and R Products, Framingham, Mass., sells sizes for transoms up to 1¾″ for $16 to $19.



Upside-down outboard is a cinch to work on with this swivel vise. Motor rotates and slides in and out for easy access. Price is about $47 from Panish Controls, Bridgeport, Conn.



Now They're Making Rifles Out of Nylon

ON YOUR left, you're looking at the world's first rifle made of the same nylon plastic that more cozily clads ladies' calves. It weighs only four pounds—up to 50 percent lighter than conventional rifles (six to eight pounds) such as the one shown at right.

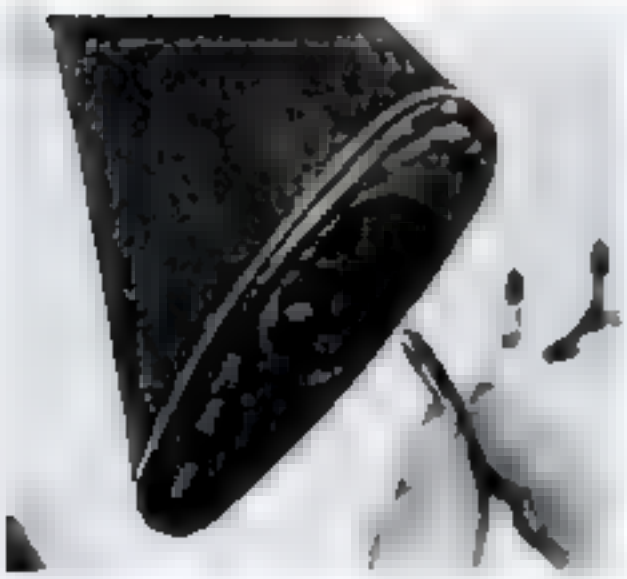
The new rifle, which will go on sale this spring, is a snub-nosed, high-styled, rapid-fire 22 semi-automatic. It fires 15 shots as fast as you can pull the trigger.

Remington designed the gun for more than lightness. They've run over it with cars, dropped it out of four-story windows, frozen it solid, dunked it in mud—and still it fires. Under all normal conditions—and a good many abnormal ones—you can't break it or jam it. Under destructive tests, the plastic—a tough, structural form of nylon developed by Du Pont and called Zytel—was going strong long after ordinary wood stocks had shattered.

The barrel, breechblock and a few other small parts are the only concession to steel. Even the receiver, in which the metal parts slide, is self-lubricating plastic that eliminates the need for dirt-collecting oil. The deceptively stubby barrel, only 19 $\frac{5}{16}$ inches long, is designed for maximum velocity from .22 long-rifle cartridges, which reach peak acceleration within that length.

A single machine can spit out fully molded, one-piece stocks at a near one-a-minute rate—an important military consideration. The design is so simple that if either barrel or stock should become damaged, you—or a soldier carrying a spare—could replace it instantly.

What future rifles might be like is anybody's guess. The present model, available in wood-grained brown or green, could be molded in white for Arctic troops, in tan for desert use, or even, says Remington, "in pastel pinks and polka dots if housewives want them." Right now, the new gun's name is "Nylon 66." It's priced at $49.95 by Remington Arms Co., Bridgeport, Conn.—*Sheldon M. Gallager.*



TO LOAD, cartridges are inserted in tubular magazine that runs from receiver to butt. Spring-loaded inner tube then puts pressure on cartridges. When last cartridge is fired, bright yellow magazine follower shows up in receiver as an "empty" signal. Magazine holds 14 shots, plus one in chamber. Rifle takes only long-rifle 22s.

INTRICATE DETAILS are molded in one pass, require no machining. Tolerances proved so tight that metal parts had to be made more accurate.

SCOPE SIGHTS FIT ON FAST using newer clamp-on mount that eliminates drilling for screws. Gun also comes with fully adjustable open sights.

QUICK-RELEASE BARREL can be removed in less than a minute. You take out three screws, then simply twist muzzle (below, left) to unlock barrel from receiver and slide it out (center). Fully removed (right), barrel can be cleaned easily, even replaced if it becomes worn.

New Ideas from the Inventors

1 Mask Pops Up for Pop-Ups. Catchers and umpires wouldn't have to rip off this recently patented mask before snagging fouls or calling close plays at the plate. At the touch of a button the protective bar would snap up to broaden the wearer's view; pulled down, the bar would lock securely in position.

2 Pillbox Watch Signals Doses. You couldn't forget to take your medicine if you carried it in a locket-like container hinged to this watch. The timepiece could be an alarm watch or an elapsed-time indicator with buzzer, but either way it would sound off at preset intervals.

3 Decanter Pours Ice Cubes. Drink cooling is usually unhygienic, says this inventor, because "nobody uses ice tongs." To remedy the oversight, he'd store cubes in a U-shaped tube so they could be poured. A hole in the base of the U would drain melted ice into a cradle stand.

4 Door Lights Flash Warning. Two flasher lights in the left door of a car would warn approaching drivers if you had to fix a flat on the danger side. Wired to flash automatically when the door was opened, they would also protect when you enter or leave a car on the left.

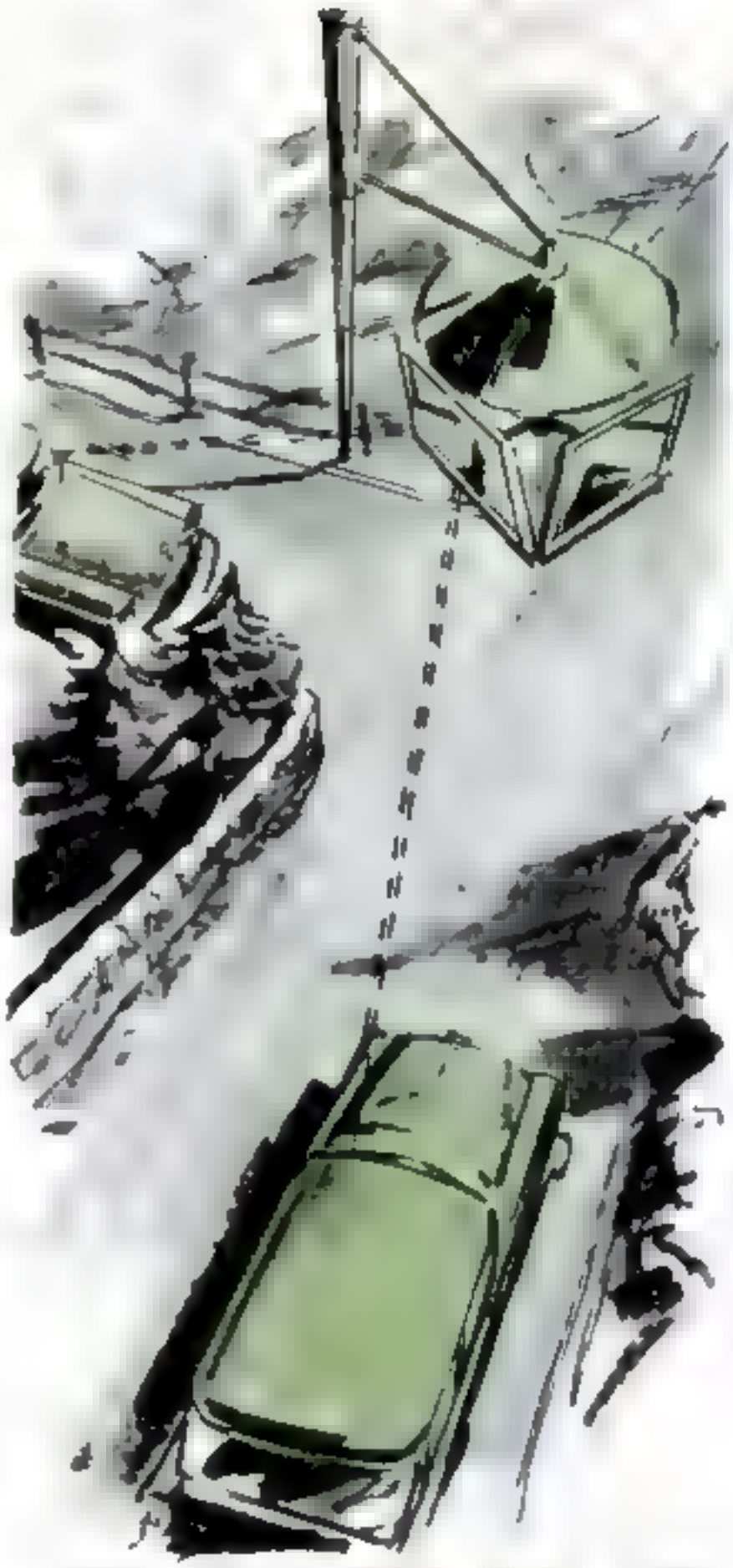
5 Opener Peels Tear Strips. Unwinding a metal sealing strip with a conventional slotted key is a slow operation and can be dangerous if the sharp strip comes uncoiled. By guiding the strip to prevent slipping, this crank-wound opener would speed the job and make it safer.

6 Hook-On Fins Steady Boat. Let down over either or both sides of a small boat, these stabilizers might prevent rocking, tipping and pitching. The leading edges of the fins would be feathered to minimize drag while the boat was in motion, but for higher-speed travel they could be cranked parallel to the sides.

Please turn the page for more new ideas

7 Shade Hides TV Antenna. Double dipoles, bent as shown, might serve as a frame for a removable lampshade cover. An insulating block at the center would join the antenna shade to a conventional lamp harp, and you could rotate the antenna by turning either lamp or shade.

8 Bed Pad Warms Your Feet. Fitted over the lower part of a bed, this electrically heated pad might warm your feet without overheating the rest of you. A thermostat would provide just the right toastiness, and with separate controls for each side of a double bed, couples made up of one cold- and one warm-footed partner might sleep comfortably.



9 Road Mirrors Show Cross Traffic. An overhanging mirror to let you see if other cars were approaching a tree-shaded or blind intersection might eliminate a common cause of accidents. With each angled to reflect cars (or lights) around a 90-degree bend, four mirrors would give visibility in all directions.

The following patents *have been issued on these inventions: 1. Patent No. 2,839,155 to John L. Sterns, NYC. 2. No. 2,853,182 to Harry E. Barnett, Chicago. 3. No. 2,762,203 to Peter Schlumbohm, NYC. 4. No. 2,844,810 to Gordon H. Steele Jr., Washington, D.C. 5. No. 2,829,797 to Henry J. Christopher, Detroit. 6. No. 2,852,874 to Ben Held, Bemidji, Minn. 7. No. 2,850,731 to Claude A. Carlson, Chicago. 8. No. 2,850,617 to Helen J. Coldren, San Diego, Cal. 9. No. 2,862,448 to Georges A. Couture, Quebec City, Quebec, Canada.*

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington 25, D.C., at 25 cents each. To write to an inventor, if the address given above is insufficient, you may address him (by name and patent number) in care of the Commissioner of Patents.

America's Supersonic Cargo Rocket

Hurtling at 1,500 m.p.h., the Lobber can carry 50 pounds of emergency supplies six miles

By Wesley S. Griswold

WHEN a part of the U. S. First Army was cut off and surrounded by German divisions during a battle in August, 1944, American units beyond the encircling Nazis stuffed rations and other emergency equipment into 105-mm. howitzer shells and fired them over the enemies' heads to the be-

TYPICAL LOBBER CREW of four soldiers can easily tote the three-part, lightweight Lobber, a standard cargo, and aluminum launcher.

The cargo-carrying missile is fired like a mortar,

SETTING UP STAKES (left) is the first job at the firing point. The launcher is aimed by sighting it along a row of stakes lined up with the target. These are set up by compass if the target is not in view.

CHECKING THE CARGO in the missile's center section (right), in which it has been transported to the launching site, these men will next attach the section to its nose and tail cone, containing a rocket motor.

sieged soldiers. This roughly effective way of delivering certain vital military supplies in a hurry has now inspired Convair Division of General Dynamics, makers of the Atlas ICBM, to create a light, simple ballistic cargo missile, the Lobber. It can hurl food, medicine, small ammunition or communications equipment to troops in such a predicament.

The nine-foot Lobber, driven to a speed of 1,500 m.p.h by a little, short-firing, solid-fuel rocket motor, can fling a 50-pound payload six miles. Bigger loads and greater range are feasible, the builders declare.

Quicker than the eye. Whooshing up to an altitude of more than 10,000 feet before starting its downward plunge, the Lobber travels so fast that no foe will be likely to see it in flight and judge where it is coming from. First warning of its presence will be the blossoming of a special landing parachute from its tail, letting it down faster and harder than the usual air-drop chute does. A shock-absorbing nose cone cushions the jolt of plumping it down at its destination.

For a "stupid" missile—so-called because it is so simple, being controlled by launch angle and spin-stabilization—the Lobber finds its way with remarkable accuracy.

Of the first three fired in field trials at Yuma, Ariz., two landed within 60 paces of each other, six miles from the launching site.

The relatively small Lobber is made of aluminum and laminated glass fibers. It weighs only 135 pounds when loaded and ready to shoot.

A four-man squad can carry Lobber, cargo and launcher. One lugs the nose and motor-fitted tail cone, another the loaded cargo section, and the two other men the launcher, which is also made of aluminum. The recoilless launcher, a tube that looks like a fat stovepipe, is mounted on a tripod with broad feet of perforated metal, which take a firm stance even in sandy or muddy soil. The

Postmaster General foresees U. S. mail-carrying rockets

AMERICA stands on the threshold of an era when its mail will be delivered by rockets, Postmaster General Arthur E. Summerfield declared recently. Perhaps with forerunners such as the Lobber in mind, he predicted that, before man travels to the moon, "your mail will be delivered within hours from New York to California, to England, to India or to Australia by guided missiles." This, he said, would be "the greatest peaceful use of missile development."

If Congress provides the money, he added, mail-carrying missiles will be painted red, white and blue, like many present mailboxes.

and 70 percent of it can be saved to shoot again

LEVELING AND AIMING the launcher, whose perforated baseplates hold it firmly in the sand, is done while the missile is being assembled.

Lobber can also be launched easily from the floor of an armored personnel carrier, from a landing ship or even from the back of a stake-bed truck, as was done during initial trials.

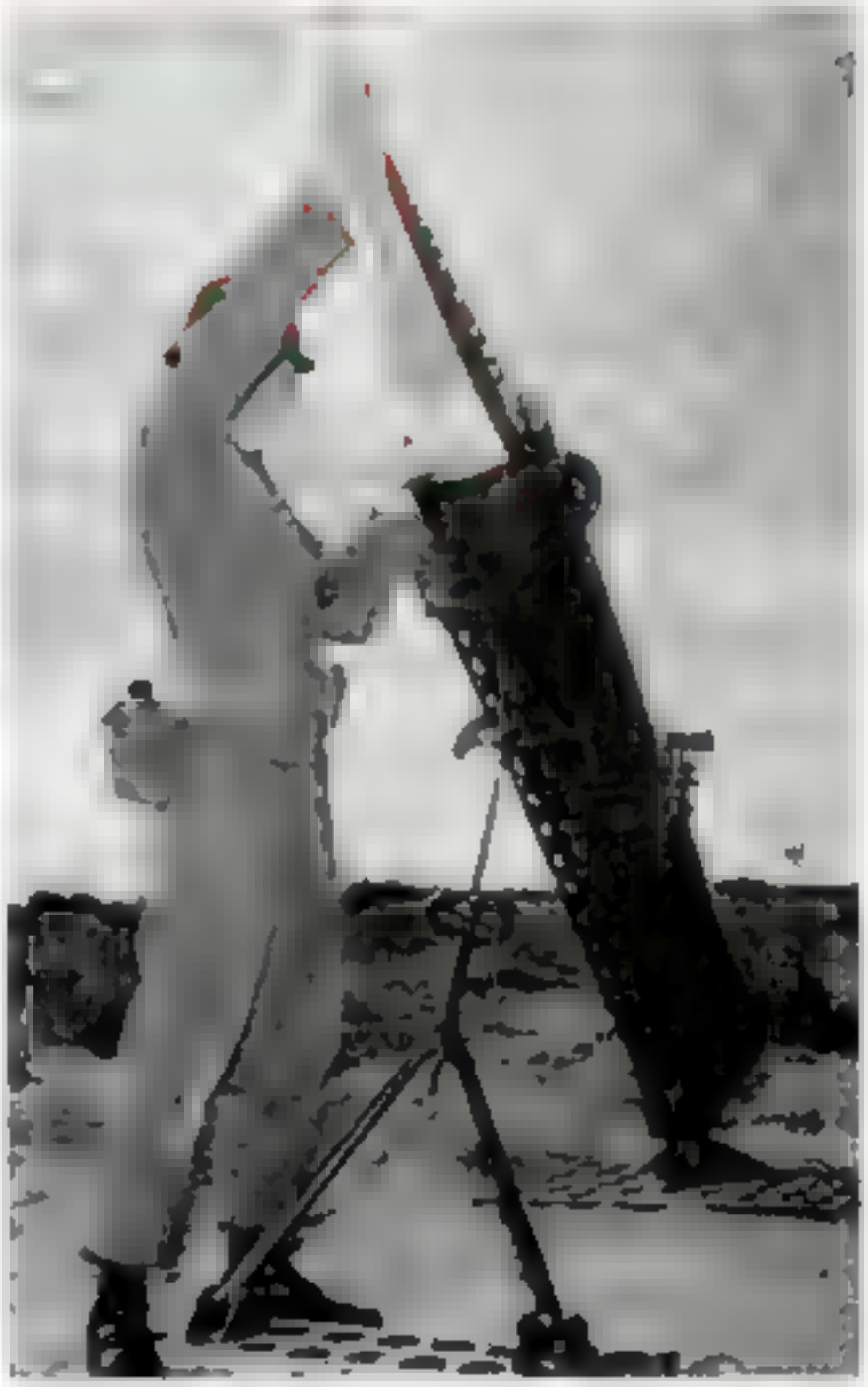
One of the most mobile Lobber units, its developers point out, would be a Mechanical Mule—the Army's smallest operational vehicle—and its driver. The Mule could tote six loaded missiles and their launcher, which the driver could set up, load, aim and fire (with a flashlight battery) all by himself. One of the Army's big transport planes could carry eight missile-packed Mechanical Mules.

Easy to learn. A Lobber is launched very much like a mortar shell. Any infantryman who can learn to set up and fire a mortar can just as easily learn to do the same jobs for a Lobber, the Convair-San Diego engineers say.

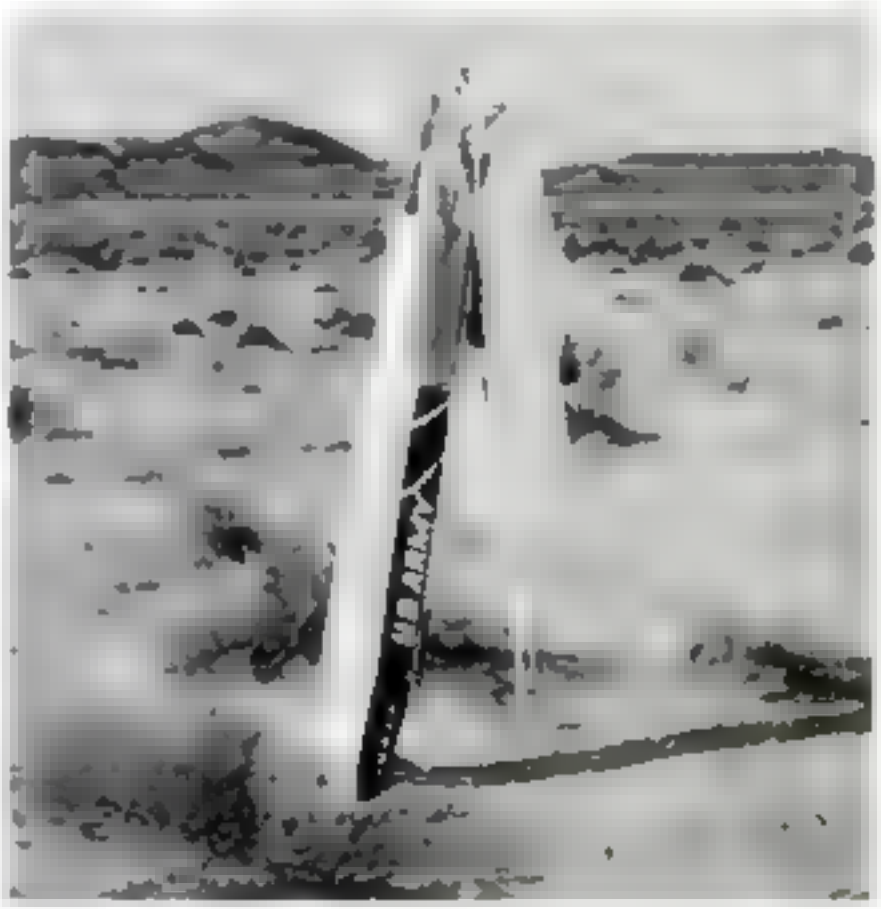
The Army, which was closely consulted in the development of this first ballistic cargo missile, suggests that cargoes could be prepackaged and stored in Lobber center sections, which are attached to nose and tail cones at launching sites. The sections can vary a few feet in length, depending on the type of cargo. Cargoes, their contents identified by number or label, could gain extra protection from landing damage by being embedded in foam plastic when packaged.

In war and peace. Army specialists believe that in addition to delivering emer-

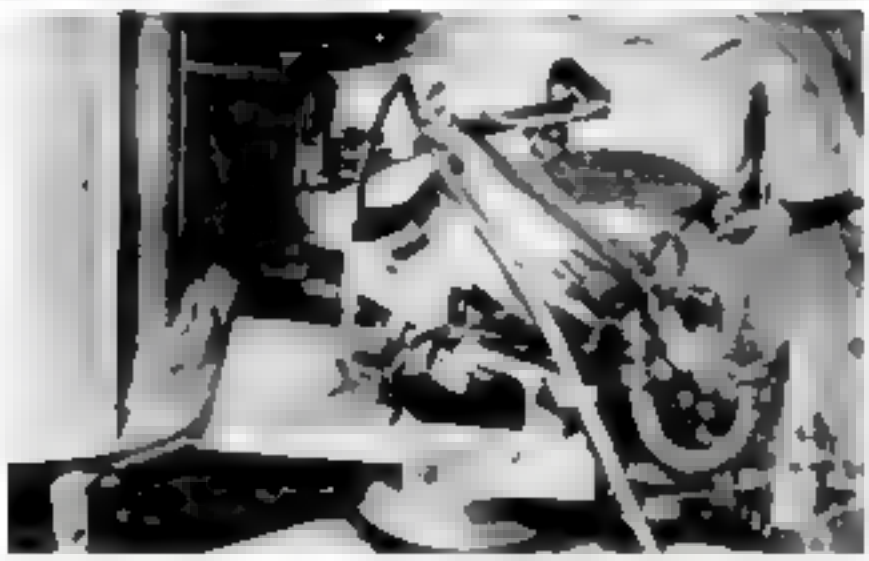
[*Continued on page 236*]

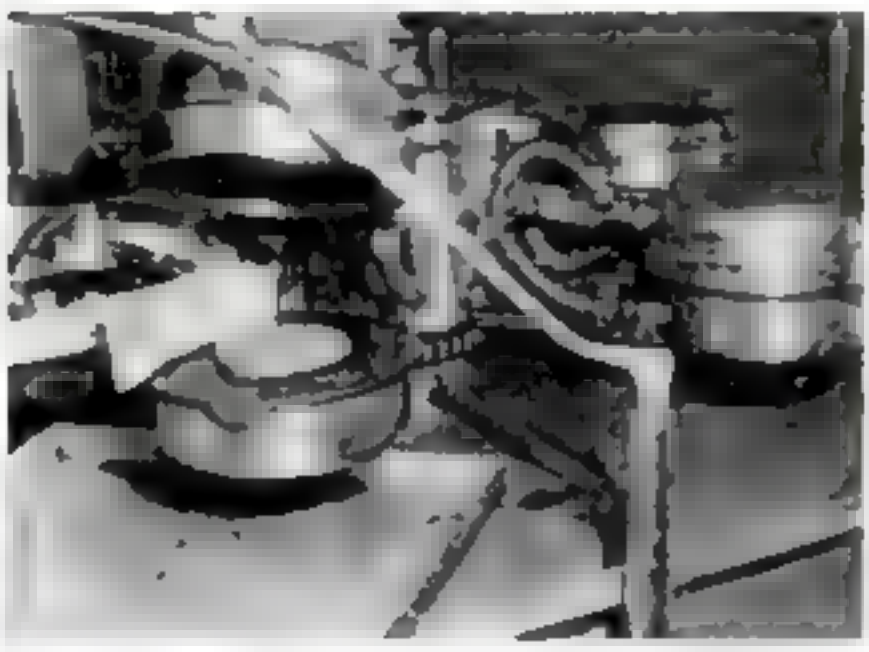


READY FOR FIRING, the Lobber above has just been slid into its launcher. The crewman's right hand clasps the special shock-absorbing nose, which cushions the landing jolt.

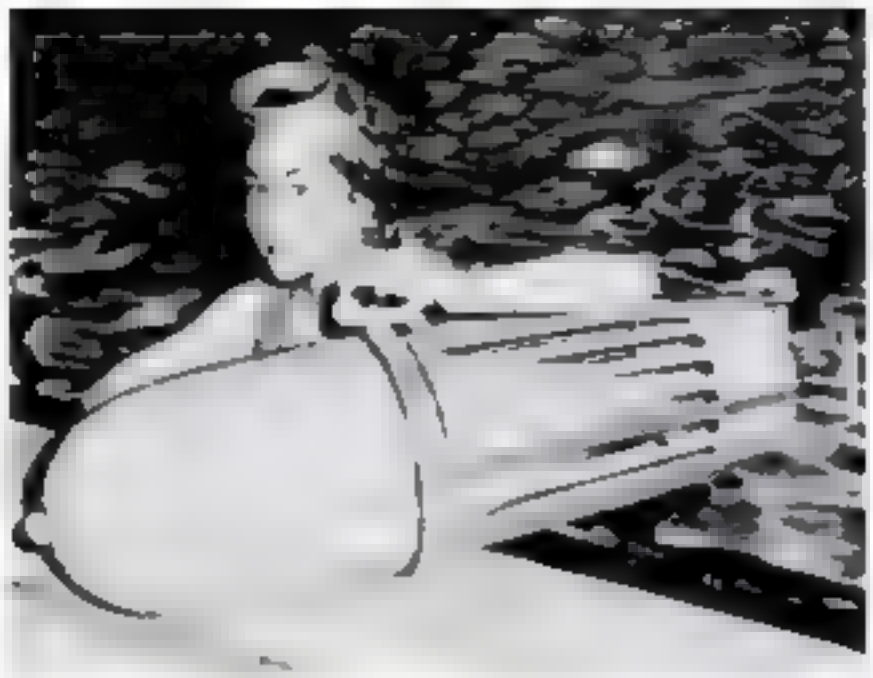


SPECIAL DELIVERY presages a day when bigger missiles may carry mail and express. A spent Lobber awaits pickup, draped in the parachute that opened when rocket fuel burned out.





BURGER AUTOMATION. Frank Nanna of San Jose, Cal., built this rotating broiler to cook five hamburgers a minute. Up to 20 pounds of ground beef in the storage cylinder (top photo) is ejected automatically in patties on a slide (center). Moved to one of five broilers, lid lifted momentarily to take it, the burger is cooked in one minute, then scraped, as the broiler opens again (bottom), onto a waiting tray, ready to serve.



DIVING AID. Towed by this battery-powered British Sub-Aqua-Jet, a skin-diver need only operate the trigger to swim or dive effortlessly. It's equipped with a camera and lights, does one knot hauling a diver at 100-foot depth.

AIR-RAID SHELTERS. Do-it-yourself bomb protection is now furnished on Formosa. These reinforced-concrete shelters sell to civilians for $11 single and $17 double. The buyer digs a hole, puts his bin in, packs it in with earth until only the lid shows, crawls in to sit out raids.

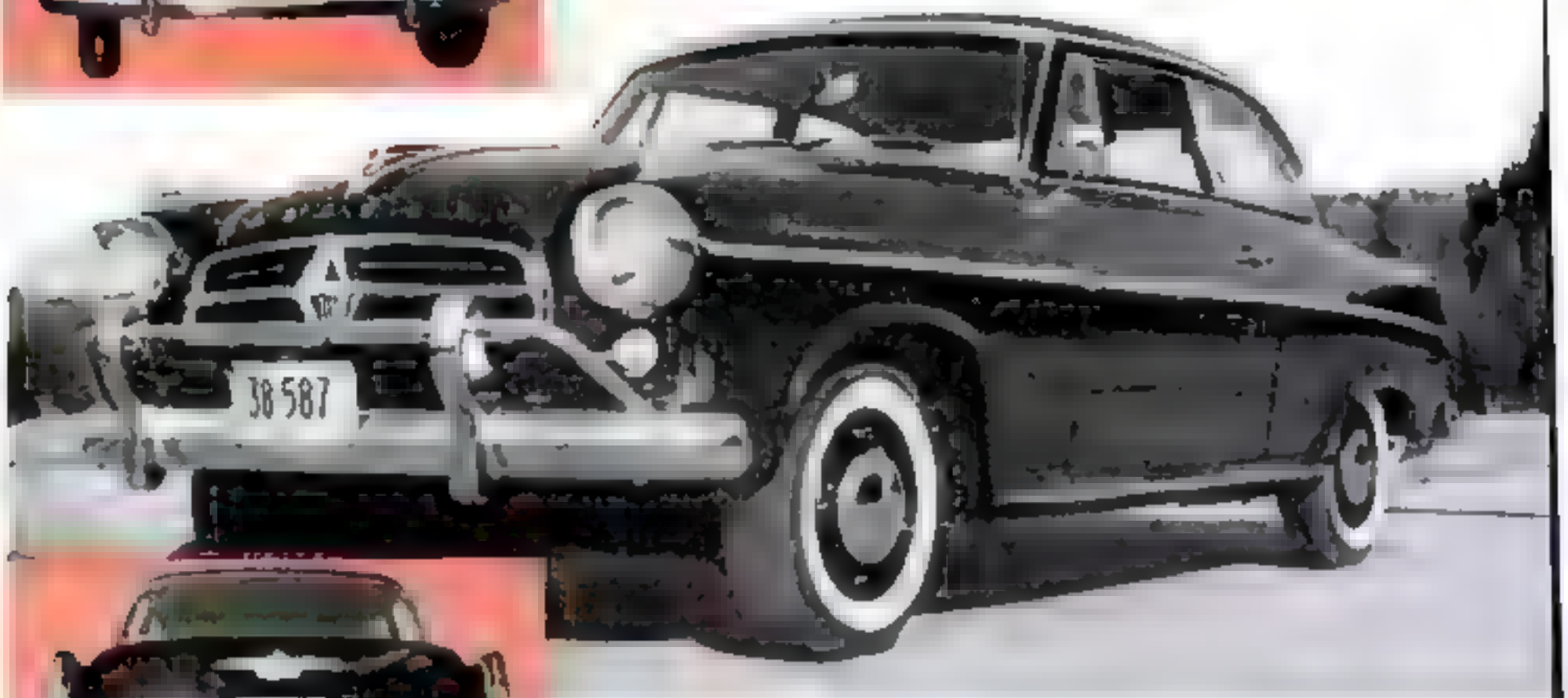
TENTED HOUSE. The tent at left was erected before the builders in Sussex, England, started on the house. Covering the construction with rainproof plastic saved them more than 70 working hours that would have been lost because of bad weather.

PINWHEEL PARACHUTE. Spinning on a swivel joint, the four sails on this new parachute reduce opening shock, give better control. David T. Barish of New York designed the chute for cargo drops, paratroopers, jet landing brakes.

CAR LIFT. The drive-on ramp of this British four-car transporter is an elevator that rises to the upper deck. One man loads and unloads the cargo with the aid of foot controls (lower photo). The ramp then folds forward for highway travel.

ANTI-SUB SUB. First nuclear submarine designed for underwater seeking and destruction of enemy subs, the Tullibee at right is under construction by General Dynamics. It is 260 feet long, will displace 2,175 tons—smallest atomic submarine yet built. Complex equipment includes new electronic hunt-kill devices.

Borgward...



Little Car

This West German husky is just about tops for cross-country driving—but it has its faults

WHEN an auto engineer turns manufacturer, you expect something different. The German Borgward is that—a quality automobile built for hard going, a family sedan with sports-car engineering, a luxury car that is miserly with fuel

Carl F. W. Borgward, at 67 one of today's few independent auto makers, also builds the Lloyd and Goliath. His Borgward-Isabella has been rolling off assembly lines in Bremen only since 1954.

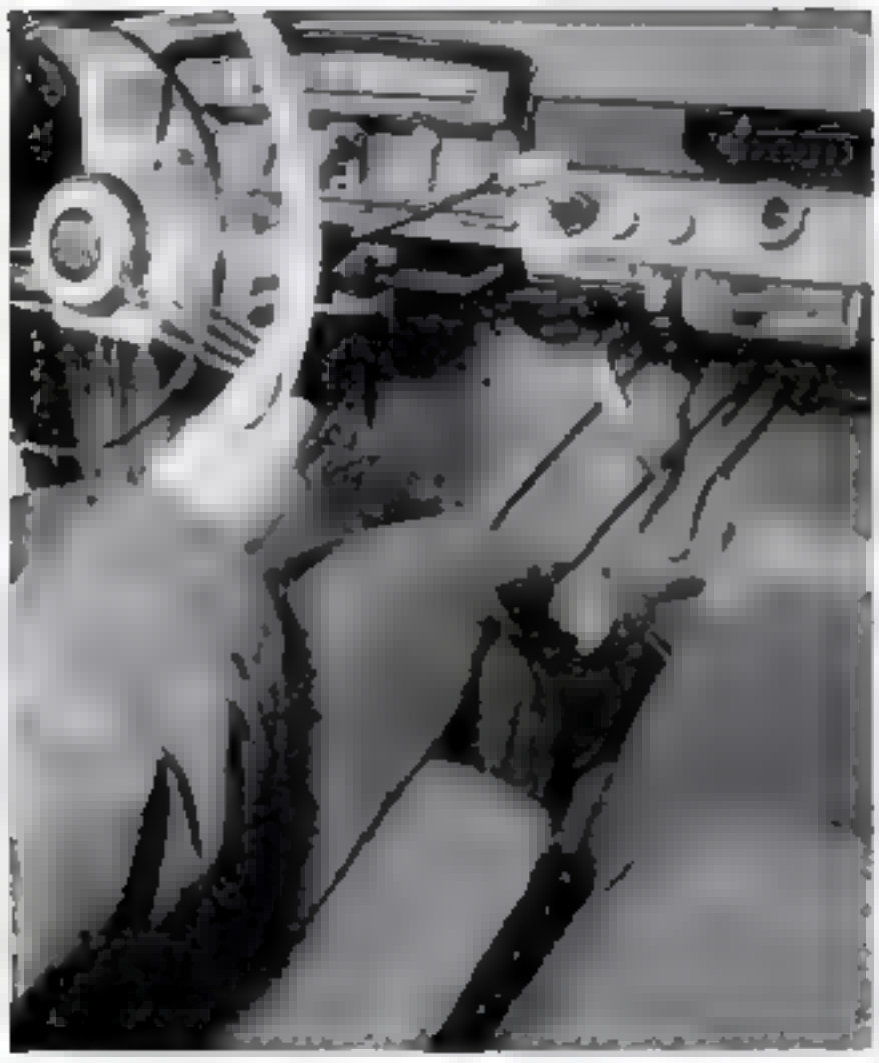
The Buick of Europe, it's bigger and costlier than the well-known Volkswagen. American buyers price-shopping a Borgward find the two-door sedan tagged at $2,495, the station wagon at $2,685.

This 102 inch-wheelbase car is a fair example of what a middle-income European looks for when car hunting. Herr Schmidt expects (and gets in the Borgward):

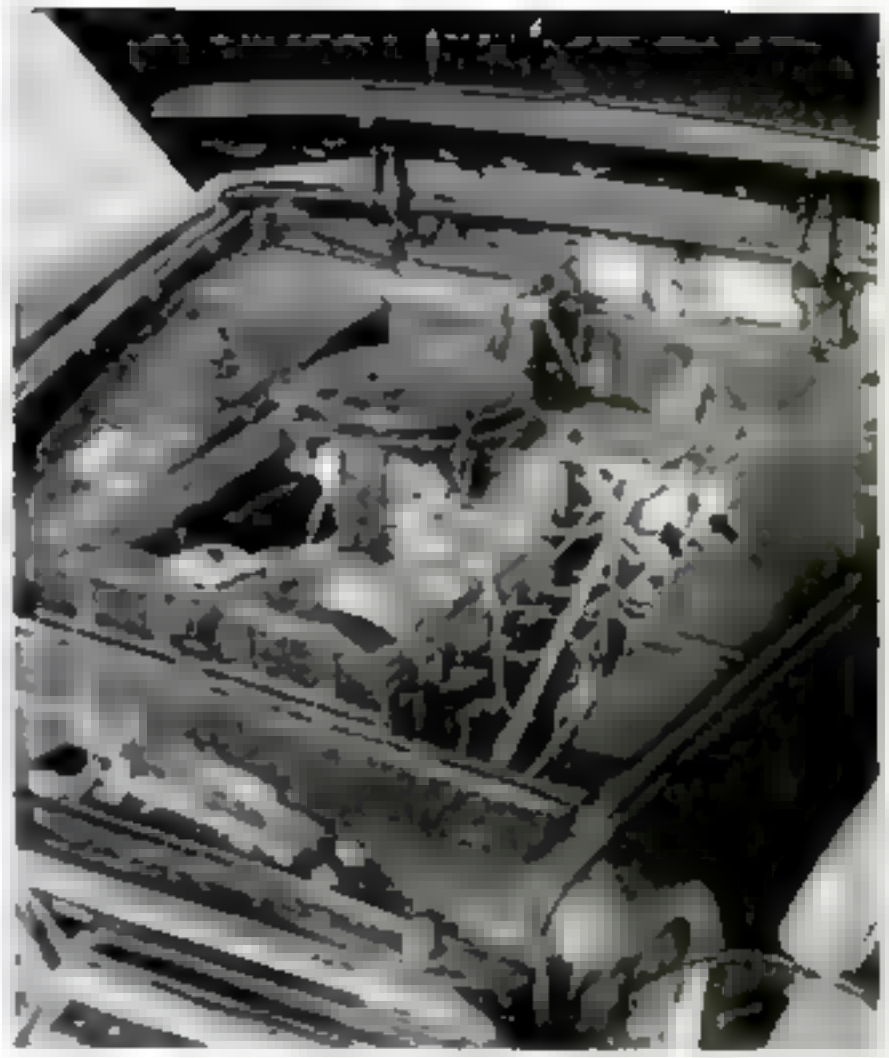
- A ride that shrugs off rough roads.
- Cornering that makes him feel like a Fangio or Trintignant.
- Power to cruise at 65 or 70—and to climb mountain grades.
- Brakes to handle those same grades.
- Fuel economy in the upper 20s.
- Seating comfort for five.

Budget permitting, the Borgward buyer can move up from the 66-horsepower sedan and wagon to the Touring Sport at $2,845 or the Sport Coupe at $3,750. In these the same basic engine is fitted with bigger valves, special bearings, a two-barrel carburetor and higher compression. It puts out 82 horsepower.

The engine is up front, the differential in the rear but fixed to a cross member in the unitized body. Two swing axles, set on coil springs, carry the wheels, cutting unsprung weight to a min-



ON THE DASH, there's a moving-line speedometer, trip and total-travel odometer, fuel gauge, temperature gauge (with a warning light that glows at 212 degrees) and an electric clock. High-beam, generator, and low-oil-pressure warning lights are in pyramid grouping.



SNUGGED DOWN DEEP in the unit-body shell, the four-cylinder long-stroke engine has overhead valves in an aluminum head. T-shaped pipe on the right returns water from twin heaters. Two reservoirs (arrows) behind it hold fluid for the hydraulically operated clutch and brakes.

with Big-Car Ideas

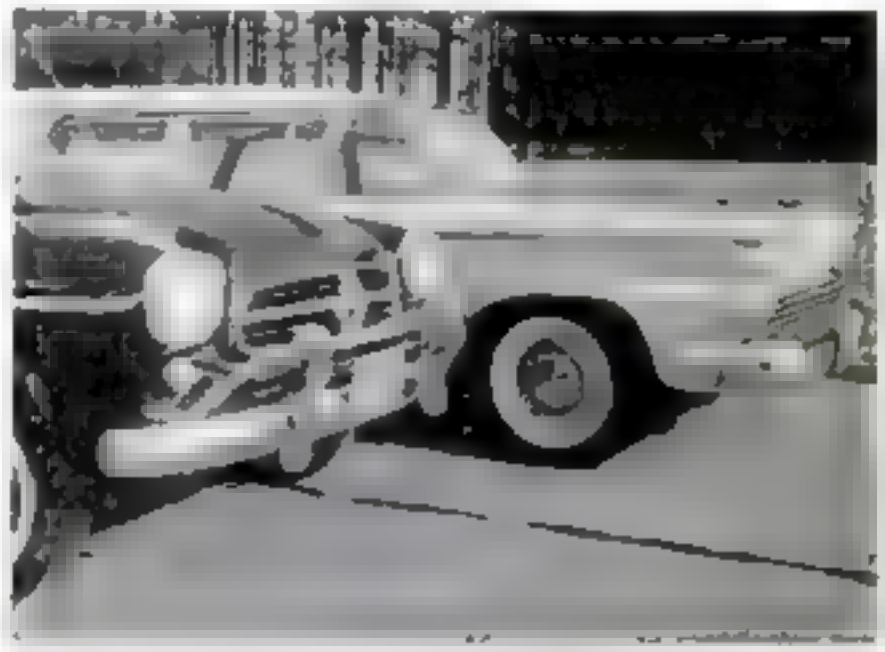
imum—a big factor in the Borgward's excellent ride and road behavior. (It's the only kind of drive suspension worth having, some race drivers will tell you.) All four wheels are dynamically balanced.

Mounted on another cross member as one detachable unit are the front suspension, engine and transmission. The overhead-valve power plant has a bore of 2.95 and a stroke of 3.32 inches. Displacement is a meager 91 cubic inches (the Lark six's is 170, the Rambler American's 196). Compression ratio is 7:1 (8.2:1 in the boosted version). But with a 3.9:1 rear-axle ratio, the Borgward engine delivers 25 to 29 miles per gallon. Good mileage? *Natürlich.*

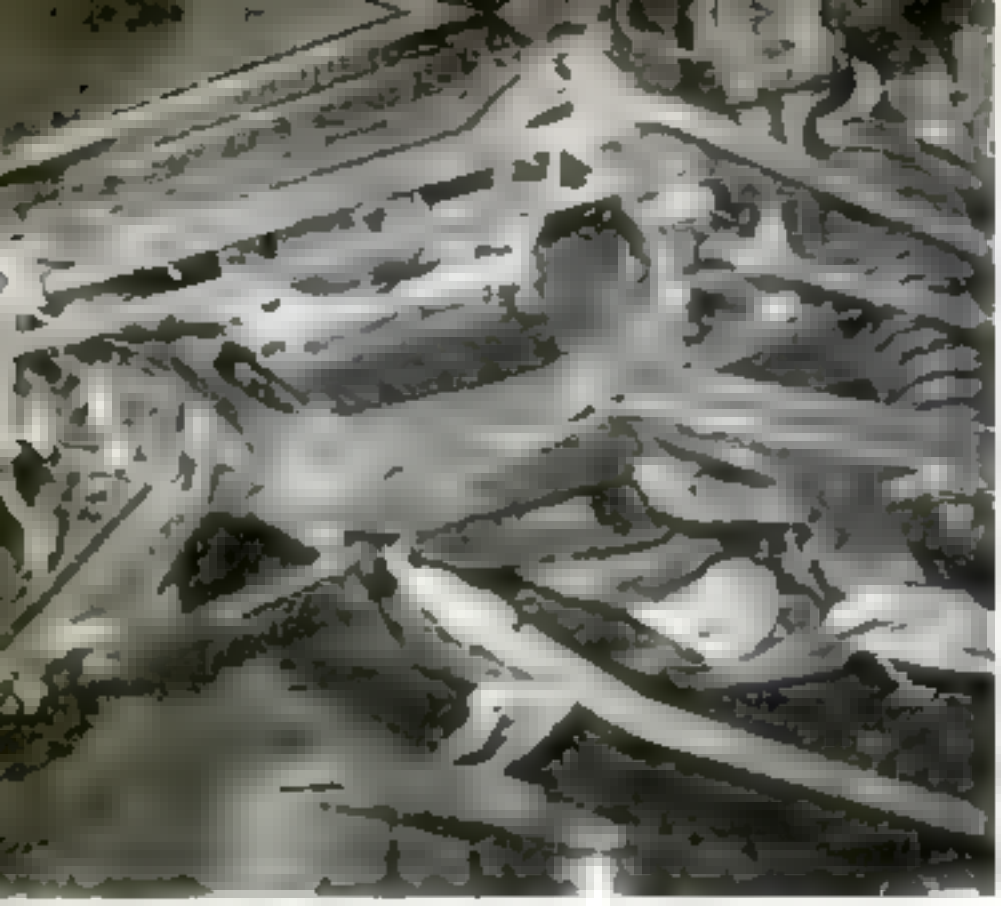
To find out more about the Borgwards, I borrowed a standard sedan and the more powerful Touring Sport from Fergus Motors in New York.

Bodies are the same, except for fender lights and a little more chrome on the higher-priced car. The Borgward is compact, but not small. Less than 173 inches long overall (38 less than a '59 Chevrolet), it's at least a foot narrower than typical American cars.

There is no gee-whiz about Borgward



SHORTER BY FEET than the 1959 Ford wagon beside which it is lined up at the rear, the Borgward turns in a 36-foot circle. Browed headlights are single. Fender lights are worn by the Touring Sport and Sport Coupe only.



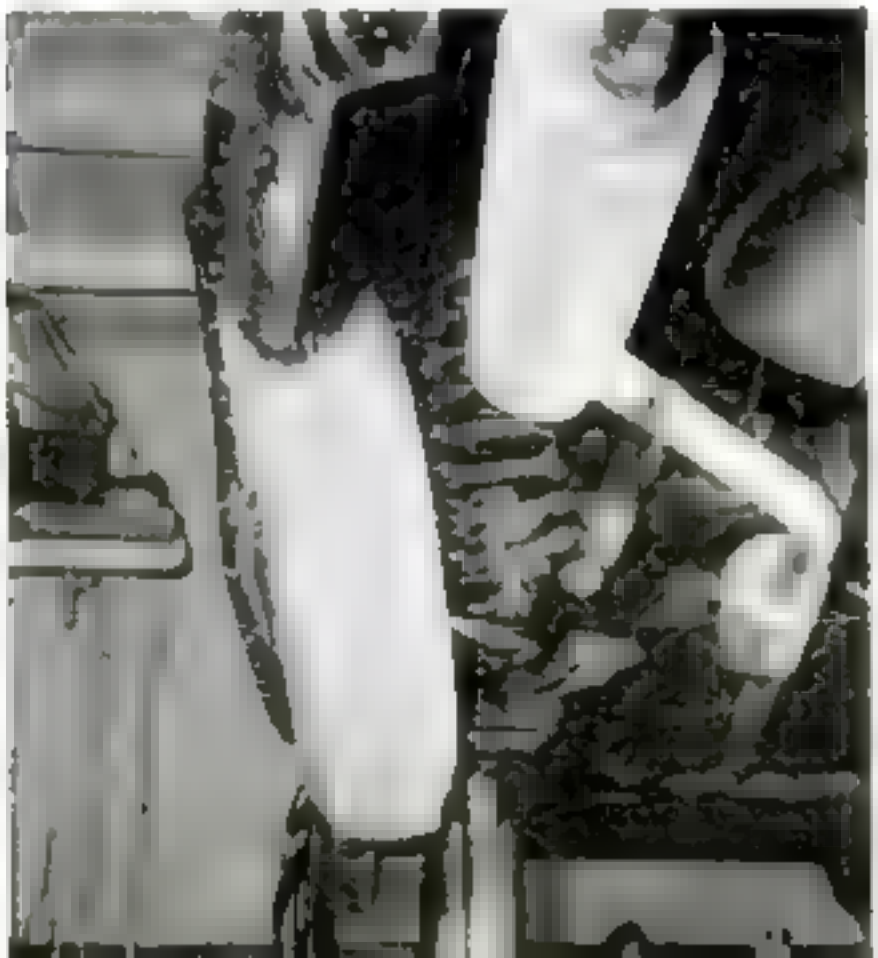
FRONT WHEELS ARE SPRUNG on conventional wishbones and coil springs, with an anti-sway bar across them (arrow). The engine, wheels and transmission are all mounted on the heavy crosspiece shown, and can be removed as a unit.

MOUNTED ON RUBBER but firmly fixed to the body-chassis, the differential drives the rear wheels through short swing axles, with radius arms taking the torque thrust. Gas tank is visible at top right, spare-wheel well at left.

styling. The car doesn't look like an arrow in flight. But it does avoid both the broad-hipped appearance of the American product and the shrunken small-car look of some imports. The body is enclosed underneath, and coachwork is so good that, as the manual quaintly puts it, "It is advisable to open a window a little when closing doors, which otherwise might be difficult due to air compression."

Up front inside, the Borgward has a gratifying big-car feel to it. A big man can stretch; leg room is a generous 46 inches, headroom a decent 36½. The front bucket seats in the Touring Sport are superb. They have a micrometer tilt adjustment to suit the most finicky sacro-iliac, and you can change it at a touch.

REAR WHEELS DROOP when off the ground, like those of the Volkswagen and Mercedes, and swing up and down on rough roads. Despite what would appear to be a scuffing action, tread wear up to 40,000 miles is reliably reported.



Except for a central hump, the floor is flat right up to the firewall, which it joins at a right angle. Pendant pedals leave the foot area clear. They're on the small side, but not so close together that you climb your own instep using them.

Looking for beefs, I found one in the shift linkage. Its throws are longer than ideal. Perhaps because the Touring Sport was brand new, getting into reverse proved tricky. Just a notch up from first, it requires a pull-out action of the lever, which inexplicably wound up in first gear at times. But as car and driver wear in, this trouble probably vanishes. All other shifts are a cinch.

Engagement of the hydraulic clutch is so smooth that even uphill starts are uneventful. You can wind up to 60 m.p.h. in third gear (or 70 with the heftier engine). Third is also the right ratio for quick traffic maneuvering

The overall top gear ratio of 3.9:1 makes for quiet high-speed cruising. Throughway driving is no strain. On hills, you learn what the four-speed, fully synchronized gearbox is for. In view of the modest engine power, top gear amounts to an overdrive. But third will let you crest most grades at 50, or provide extra passing zip on the level.

The Borgward ride on smooth pave-

ment about equals that of Detroit cars. Drop off onto a rough shoulder or take a bumpy road, and the German car comes in ahead as the four-wheel independent suspension shows its stuff. Most bumps and holes are flattened out somewhere between the wheels and the seat of your pants. Those that aren't are held strictly to account by four telescopic shock absorbers. A fifth one, on the steering linkage, keeps road shocks from reaching your wrists.

Rear-drive swing-axle cars are supposed to oversteer. The Borgward begins to show this only in fast cornering. Normal steering is so obedient and effortless that you feel like a passenger at the wheel. Should the inside drive wheel break loose on a turn, a little more gas will put it back down.

Braking is sure, thanks in part to the suspension. There are 119.4 square inches of brake area to the car's 2,204 pounds, or 18½ pounds of weight per square inch—a ratio better than the Plymouth's 18.6 or the Imperial's 18.8, and almost as good as the Chevrolet's 18.1 Borgward stops are straight and certain even after repeated hard braking.

On road behavior, I'd come close to picking the Borgward as the car I'd most like to have on a cross-country drive, whether by turnpikes or take-as-they-come highways. It's as relaxing a touring automobile as one could ask. But it isn't a car for stop-light drags. I couldn't do better than 15.1 seconds in zero-to-50 runs with the 66-horse engine. The 82-horsepower car, too new for a legitimate acceleration try, would probably beat this by only a couple of seconds.

TRUNK GRIPE IS JUSTIFIED by the fact that the lid rises only 45 inches from the ground, making its edge and latch plate dangerous head bumpers. Trunk capacity is about 15 cubic feet. The spare wheel is under the floor mat.

Docile parking manners proved a surprise—because of the Borgward's big-car feel. Pulling up alongside a station wagon that took every inch of its meter space, I got set for some close maneuvering to enter the one behind it. But the Borgward snugged itself in at first try with no white knuckles on the steering wheel.

Looking closely at the inside of the Borgward, nobody could find fault with

[*Continued on page 238*]

TURNING A BIG KNOB on the outside of each front seat in the Touring Sport adjusts back tilt. Folded down, seats form a 59-inch-long bed, with extra foot space under dash. Front hip room is 58 inches, shoulder width 53½.

TO OPEN TRUNK, pull the T handle under the left-hand armrest. No key is needed, and there's no lock that can be picked, but accidental release could be a hazard in heavy traffic. Rear windows are front-hinged, swing open.

What's New

CAR-TOP CAMP tilts quickly off pivoted roof rack (top), can be set up as roadside picnic shelter in two minutes (center), or as full tent in seven minutes (bottom). Sky-Camp comes complete with two-burner stove, two beds, two chairs, tent, sink and water tank for $660.

for the family car

It had to come: A rear-view periscope can now be mounted on your car's roof to give you an unobstructed view of traffic behind you. The scope also incorporates a wide-angle mirror in the conventional position inside the car to give you an additional view through the rear and side windows. National Safetiscope says their $59.95 periscope can be installed in about an hour. Only problem encountered by those who've tried it is that looking where you've been is so fascinating you have to keep remembering to look where you're going, too . . . Anyone who has to change license plates frequently, such as auto dealers, can get a magnetic holder —you just slap the plate on and it sticks. Cleveland Products sells it for $6 . . . Touch-up paints to match each year and make of car now come in spray cans by Dupli-Color for quicker, smoother results . . . Popularity of gold trim has also prompted Du Pont to bring out a metallic-gold touch-up. The Tip-on appli-

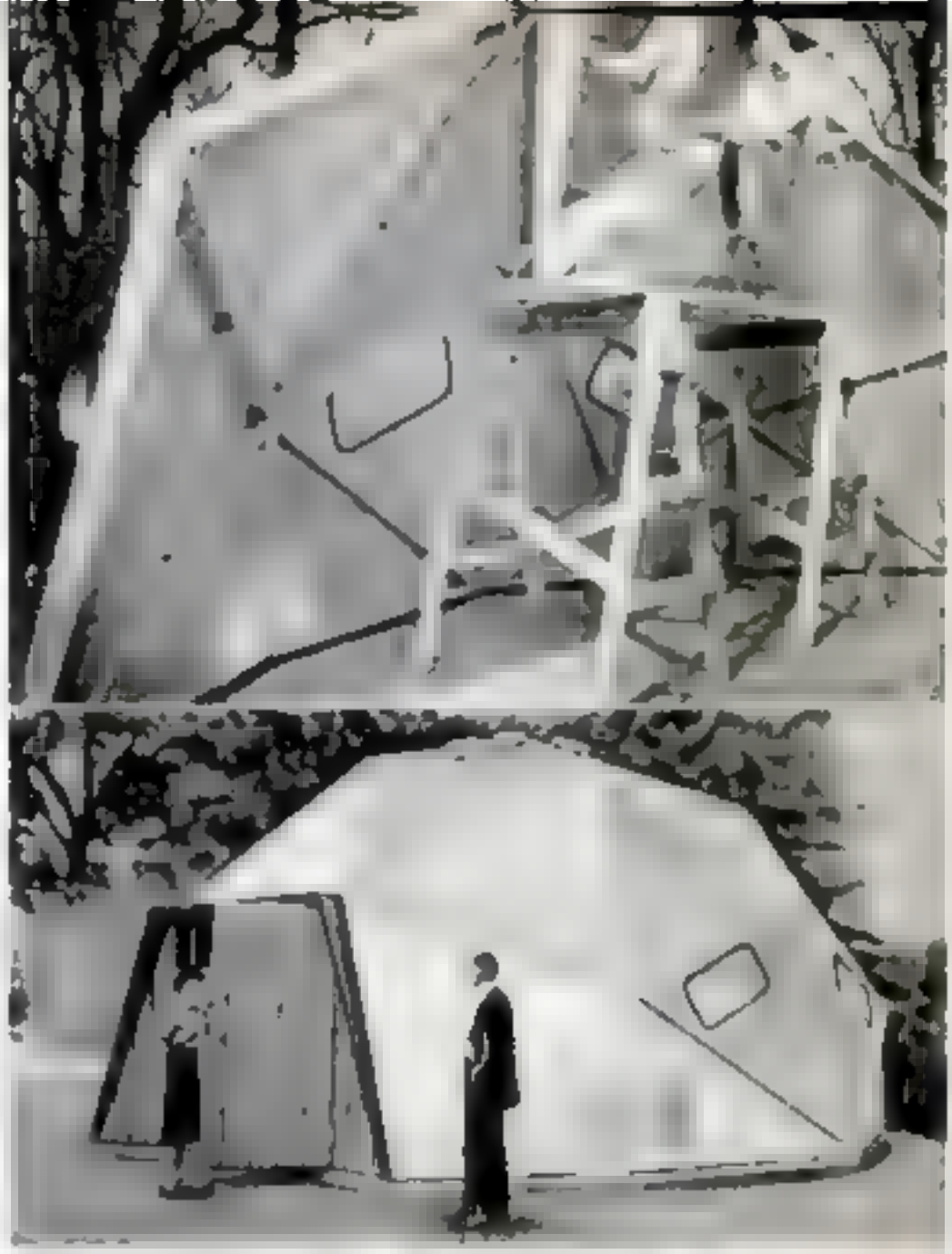
TRAVELING COFFEEPOT runs on house current or plugs into a car's 12-volt lighter socket. Price for Coffeequick is about $19.

GAS-SAVER cuts fuel pressure at idle and cruise, reducing waste. The AC Spark Plug unit hooks into fuel line, sells for $9.90.

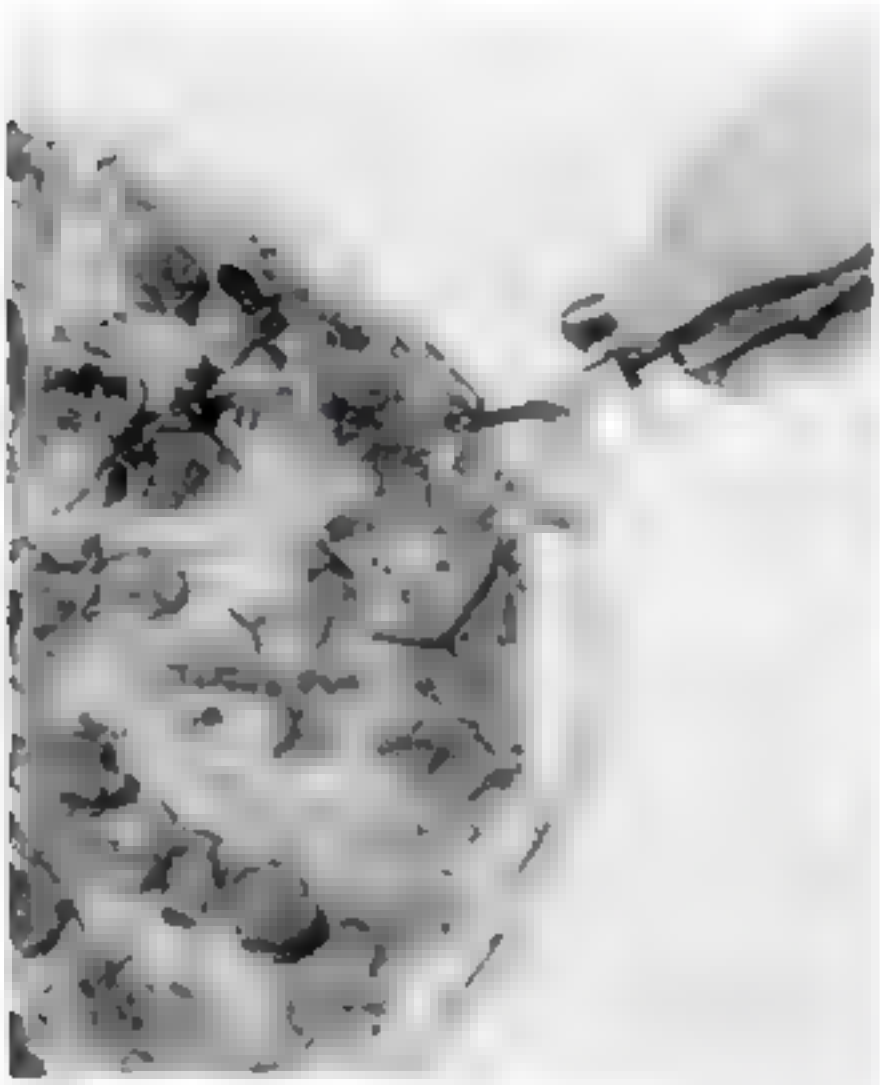
cator with built-in brush sells for $1 . . . New Lee oil filters contain a tiny rod of Feridium designed to act as a "sacrificial anode," similar to those found in water heaters. Metal-eating acids in the oil go after the Feridium instead of your engine, Lee says, and are neutralized by the chemical reaction. A pleated paper element performs the conventional job of mechanical filtering as well.

for your home

Baby concrete mixer holds five gallons and runs on a ⅓-hp. electric motor to speed masonry chores around the home. The Modern Mfg. Co., which sells it for $59.95, says one man can mix 2½ cubic yards a day with it . . . New ventilation fans designed to mount in the underside of roof eaves are claimed to cool better than conventional attic fans and cost less. Made by the Phil Rich Fan Mfg. Co., they're said to drop attic temperatures as much as 50 degrees on a 95-degree day outside . . . Pegboard is easier to put up now. New rubber wall spacers fit snugly over the mounting screws so they can't fall off just when you get the board halfway up. Masonite makes both the Pegboard and the spacers.



PORTABLE DOMES, based on geodesic principle, now come in kits for garages, summer cabins, other uses. Triangular plywood panels can be bolted together in 10 hours, taken apart later and moved with you. Pease Woodwork Co. sells the 14-high, 26-diameter dome for $596.



PIZZA CUTTER wheels in to cut a neat slice from a gooey, tacky pie. Hyde Mfg. Co., famous for wallpapering and other tools, sells the non-wallpapering cutter for $1.59.

QUICK PUPS. Westinghouse cooker turns out six hot dogs in 90 seconds by "electrocuting" them between electrodes. Vital statistic: Americans consume 11 billion red-hots a year.

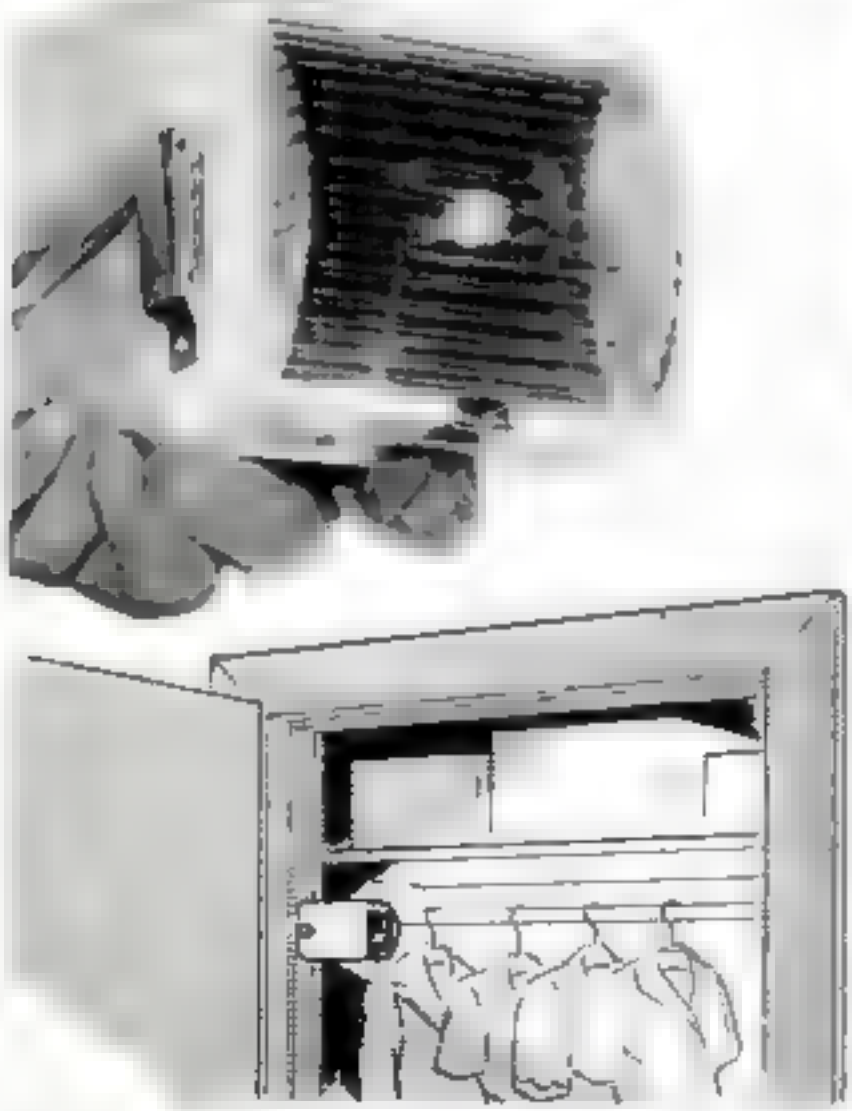
More new products on the next page

PLASTIC "STONE" now comes in special weatherproof type for facing exterior as well as interior walls. PanelStone sheets are 4' by 8', represent brick, fieldstone, other masonry.

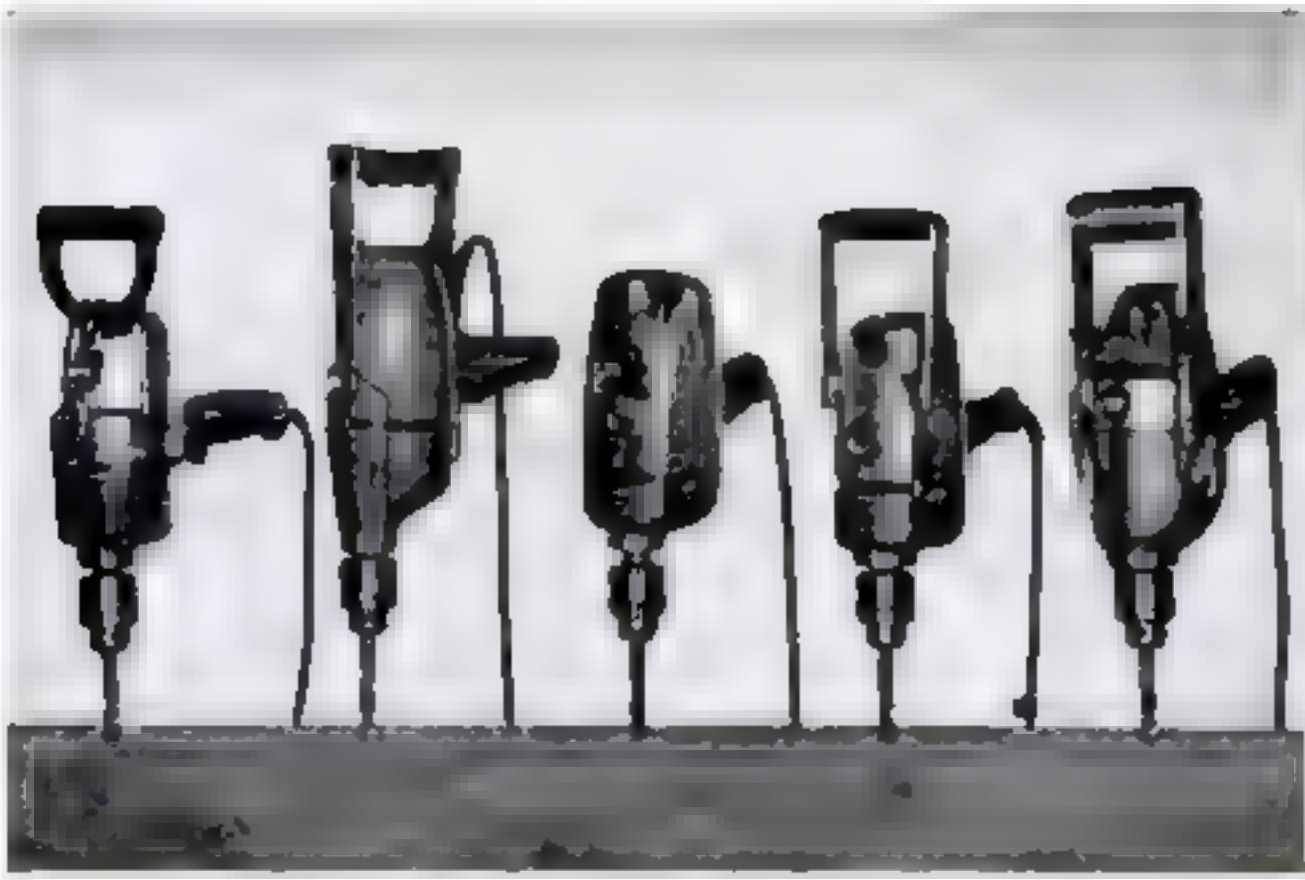
the latest in tools

New abrasive blades for portable saws by Clipper use glass-cloth reinforcement to speed cutting and guard against shatter on brick, block, tile and other masonry . . . Inexpensive bits for electric drills give you eight sizes of spade-type cutters from ¼" to 1¼" that snap into one universal shank. A Parker bit set will cost you $2.75 . . . Small-parts trays made to hang on perforated board are 18" long, sell for $2 from Industrial Marketing Service . . . Quick-change motor mounts make it easy for one motor to serve several shop tools. A baseplate bolted to the motor slides into an interlocking plate on each tool. Basic kit of two tool mounts and one motor base is priced at $4.95 from the Mercury Motor Mount Co. . . . If you keep losing tiny Allen wrenches, you can get a set of seven sizes that swing out of a holder like blades in a pocket knife. Upland sells it for 98 cents.

BATTERY-RUN CLOSET LIGHT goes on when you open the door, needs no wires, can be slipped off mounting bracket for use as a flashlight. The Hollis Porta-Lite sells for $1.25.

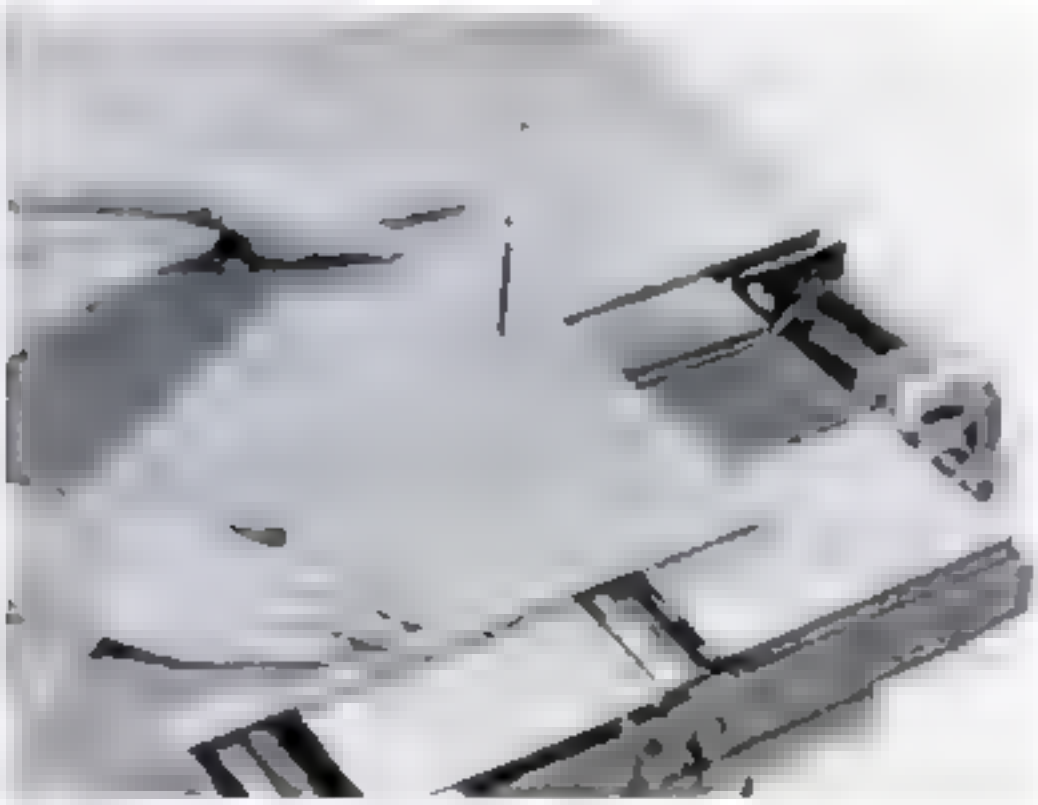


KITCHEN CONTROL CENTER lets your wife pilot up to six appliances at a time or keep them neatly stored in special racks. Sunbeam unit has clock timer, pushbutton circuit breakers.



SLICKED UP, SLIMMED DOWN: New ½" electric drills, once considered strictly pro, are styled with a new eye on the home-shop market. Some weigh as little as eight pounds, sell for less than $50. Left to right: Black & Decker, Millers Falls, Remington, Sunbeam, Thor.

TWO NEW BLADES, half-round and fine-cut, have been added to Stanley's line of Surform smoothing and shaping tools. Both fit either the plane or file holder, sell for 98 cents each.

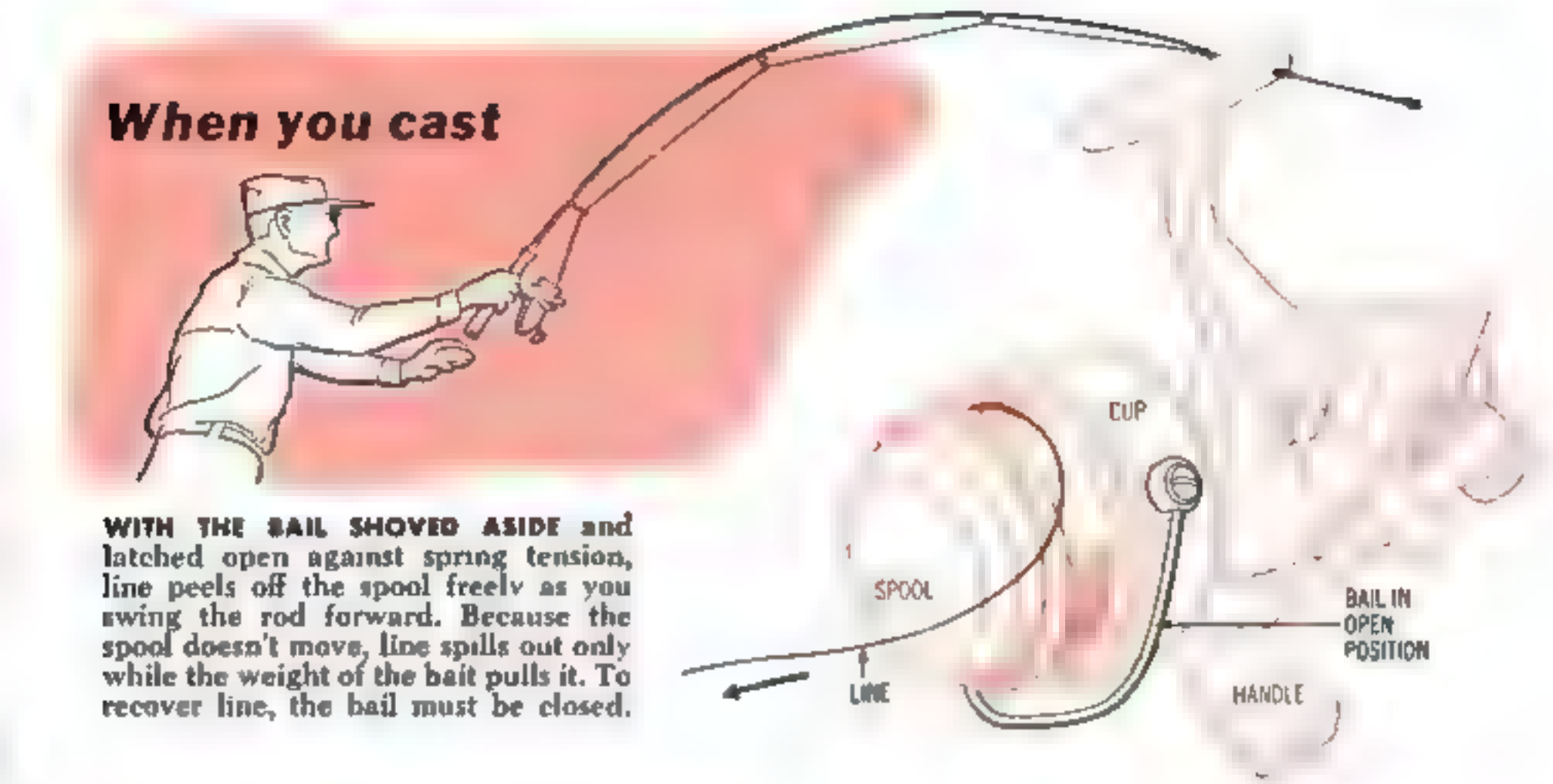


FIVE-IN-ONE-TOOL is Sears, Roebuck's new entry in the multipurpose field. Basically an 8" tilting-arbor bench saw, it sets up as a saber saw (above), jigsaw, disk sander and 4½" jointer-planer. Center pedestal makes it easy to reach. Price: $5 down, $189.88 total.

for more information:

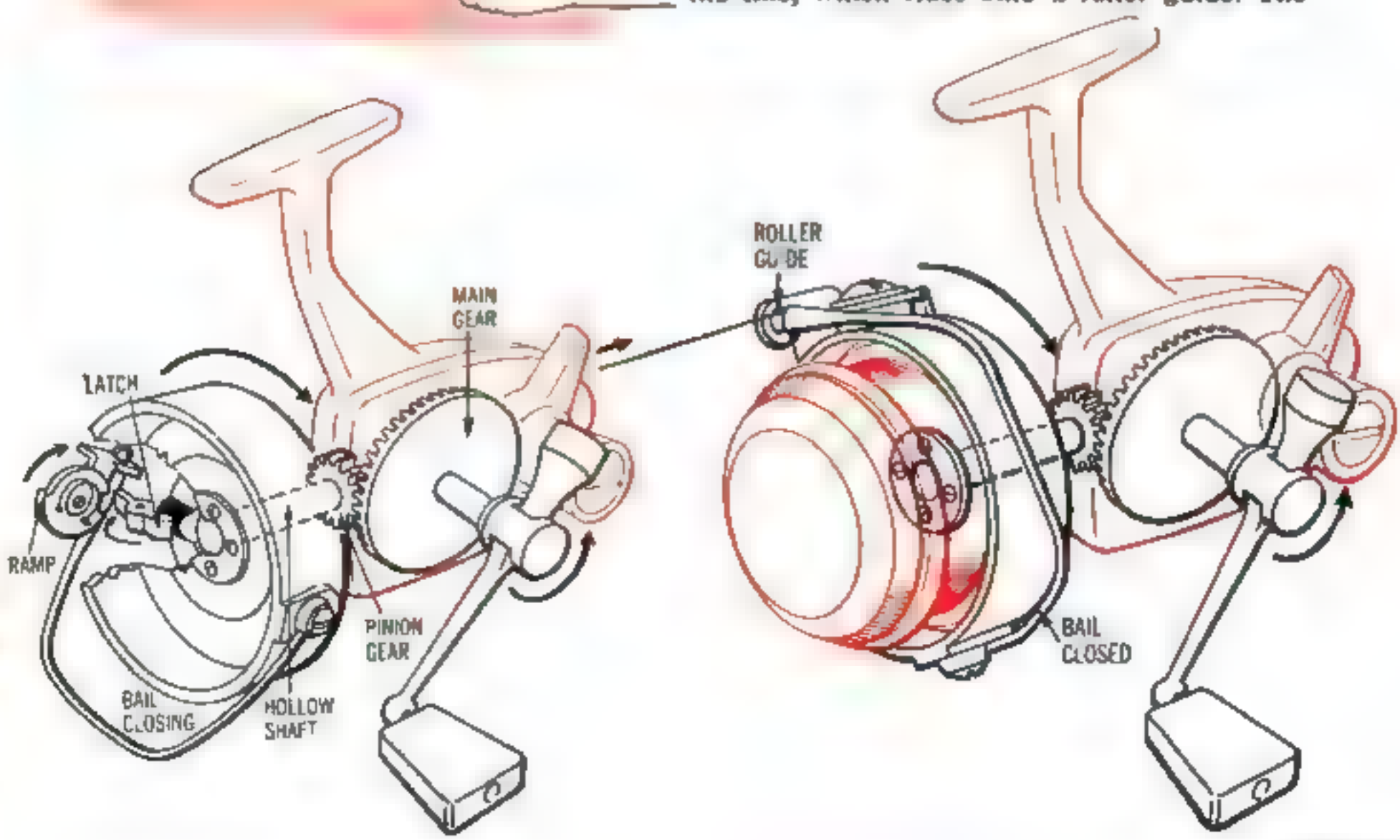
Here's where to write if you can't get any item listed. **AC Spark Plug Div.**, *General Motors, Flint 2, Mich.*; **Black & Decker**, *Towson 4, Md.*; **Cleveland Products Co.**, *Cleveland Bldg., Rock Island, Ill.*; **Clipper Mfg. Co.**, *Kansas City 8, Mo.*; **Coffeequirk**, *P. O. Box 643, Ithaca, N. Y.*; **Duplicolor Products**, *Chicago 16*; **E. I. du Pont de Nemours, Inc.**, *Wilmington, Del.*; **Hellis Co.**, *1133 Broadway, N.Y.C.*; **Hyde Mfg. Co.**, *Southbridge, Mass.*; **Industrial Marketing Service**, *P. O. Box 2214-Ft. Dearborn Sta., Dearborn, Mich.*; **Lee Filter Corp.**, *41 River Rd., North Arlington, N. J.*; **Masonite Corp.**, *Box 777, Chicago 90*; **Mercury Motor Mount**, *P. O. Box 48371, Los Angeles 48*; **Millers Falls**, *Greenfield, Mass.*; **Modern Mfg. Co.**, *Pasadena, Cal.*; **National Sabrescope Corp.**, *206 N. Virginia St., Reno*; **PearlStone**, *6111 Sylmar, Van Nuys, Cal.*; **Parker Mfg. Co.**, *Worcester, Mass.*; **Prase Woodwork Co.**, *Hamilton, Ohio*; **Phil Rich Fan Mfg. Co.**, *2900 Caroline St., Houston 4*; **Remington Arms**, *Bridgeport, Conn.*; **Sears, Roebuck**, *925 S. Homan Ave., Chicago 7*; **Sky-Camp Stores, Inc.**, *9237 Long Beach Blvd., South Gate, Cal.*; **Stanley Tools**, *111 Elm St., New Britain, Conn.*; **Sunbeam Corp.**, *5600 Roosevelt Rd., Chicago 50*; **Thor Power Tool Co.**, *Speedway Mfg. Co. Div., La Grange Park, Ill.*; **Upland Industries**, *Upland 7, Pa.*; **Westinghouse Electric Corp.**, *246 E. 4th Ave., Mansfield, Ohio.*

How a Spinning



WITH THE BAIL SHOVED ASIDE and latched open against spring tension, line peels off the spool freely as you swing the rod forward. Because the spool doesn't move, line spills out only while the weight of the bait pulls it. To recover line, the bail must be closed.

THREE THINGS HAPPEN: 1) Cranking the handle to reel in flips the bail closed first. The handle rotates the main gear, which turns the cup and attached bail by means of a pinion gear and hollow shaft. Before the cup makes one complete revolution, the bail latch (fastened inside the cup and protruding through a hole in the back of it) rides over a stationary ramp and is tripped. 2) As the bail snaps closed it intercepts the line, which rides onto a roller guide. The

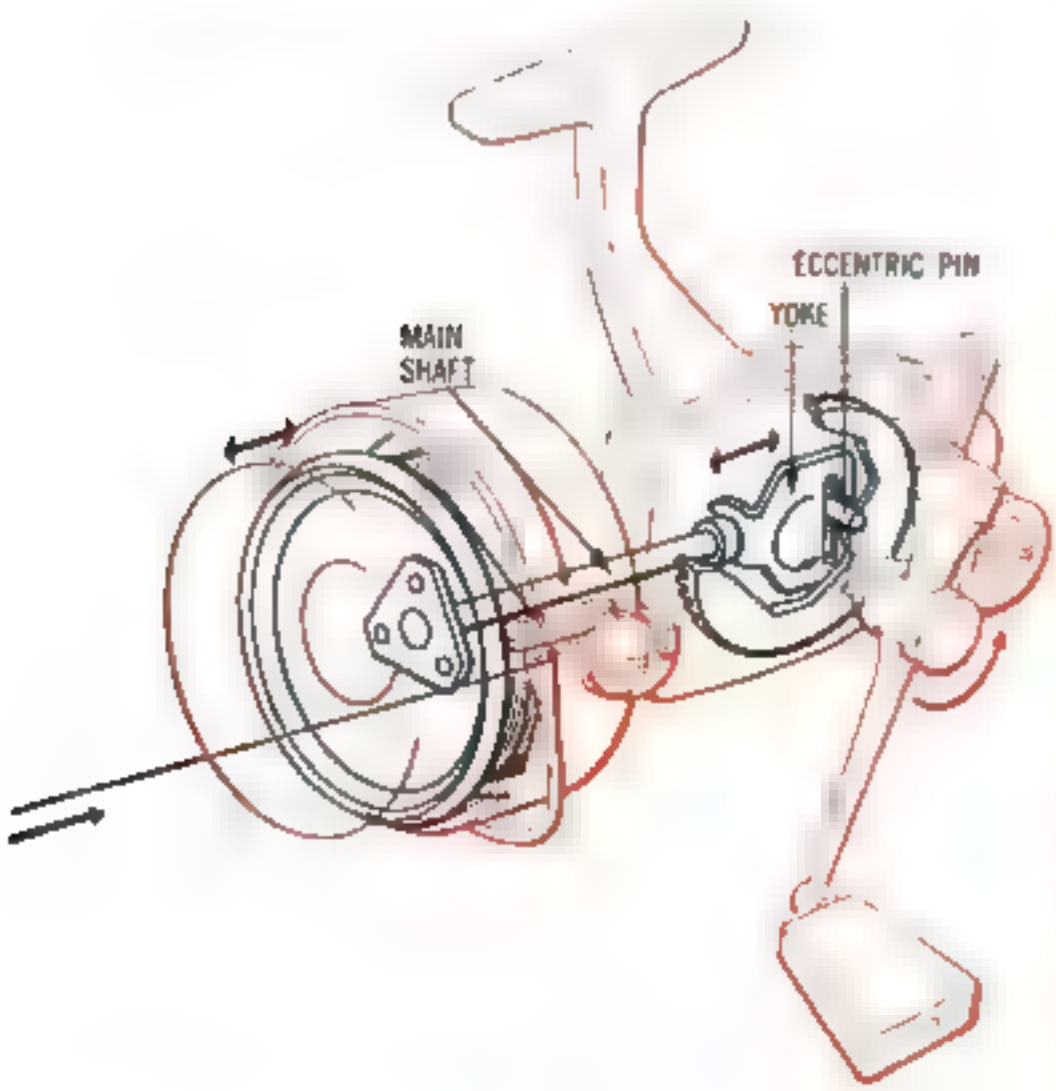


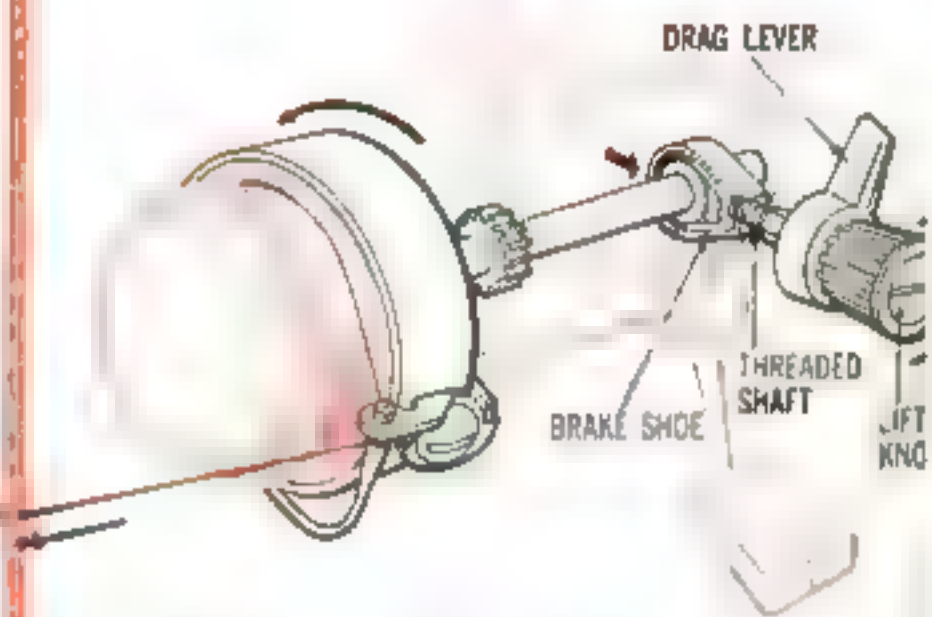
Reel Works

A COMPLETE dub at fishing, they say, can pick up a spinning rod and in 10 minutes learn to cast a good 100 feet. With a bit more experience he can drop a lure or piece of bait as light as $\frac{1}{16}$ oz. wherever he wants it, up to 150 feet away. Spinning reels are so easy to use because the spool stands still and the line spins off it; there is very little friction and no backlash at all.

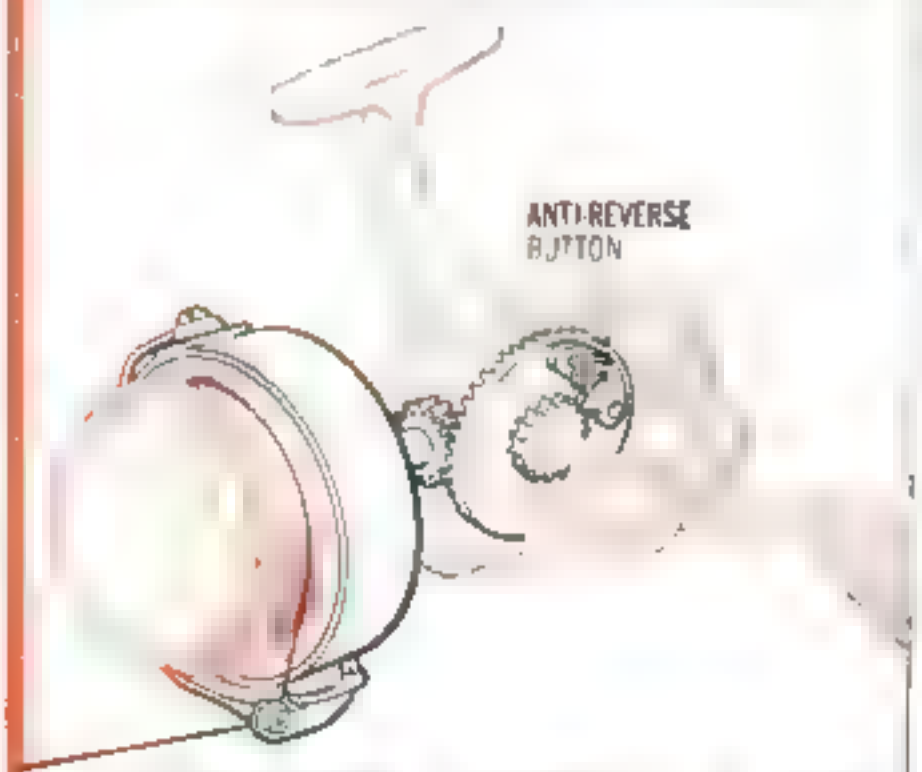
Today every major tackle maker offers fresh- and salt-water spinning reels. The drawings used here are based on an Airex Larchmont. Spinning is popular now, and has been for a decade. But when the first reels were brought over from Europe in 1932 they had an uphill fight to win acceptance. Bait casters in particular, their thumbs educated to prevent backlash from fast-turning reels, were slow to try them.—*Erik Arctander.*

line is wound onto the spool by the rotating bail as you continue to crank the handle. The spool does not turn. 3) The spool moves in and out, however, to lay line on evenly. It's held onto the end of the main shaft by a spool nut. The main shaft, which passes through the hollow pinion shaft, has a yoke on the other end that rides on an eccentric pin on the main gear. Rotary motion thereby becomes reciprocal, in-and-out motion to spool the line on smoothly.



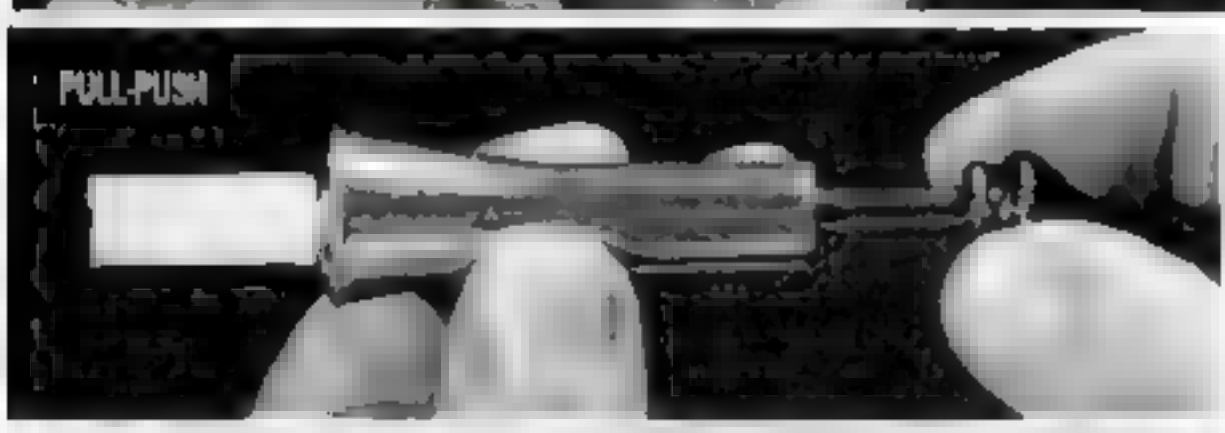


LINE PAYS OUT AS THE FISH PULLS while you are reeling in or have the anti-reverse lock on (see below). Because the bail is closed, the line rotates spool and main shaft as it unwinds. Flipping the drag lever ON screws in a threaded shaft and presses the brake shoe against the main shaft. The fish's pull is then resisted by friction between brake and main shaft. To adjust drag so it matches line strength you turn the threaded drag shaft with a pull-out knob that fits into the drag lever.

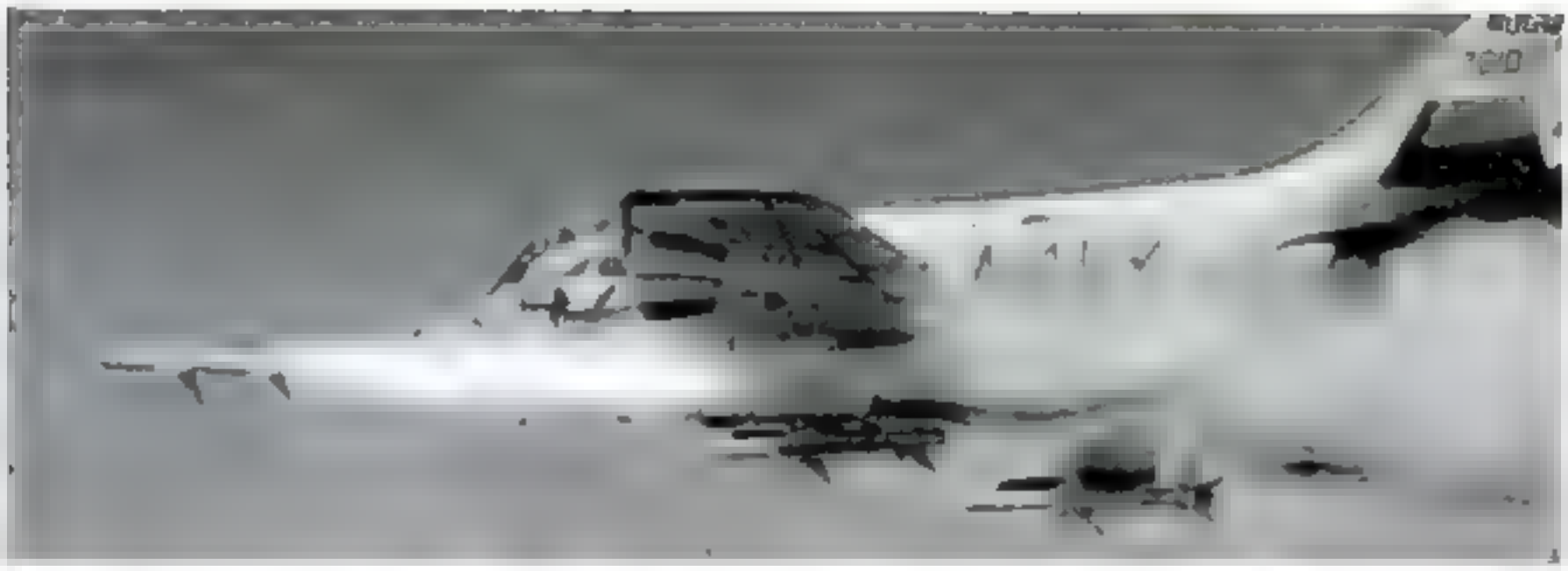


A PAWL ENGAGES A RATCHET on the same shaft as the main gear when you shove the anti-reverse button on. Now the handle and the bail driven by it will turn in only one direction—to reel in the fishing line.

WORLD'S FAIR CITY. Belgium is planning an independent "city of the future," to be finished in 1961, on the site of last year's Brussels World's Fair. Shown in the architects' scale model here are a modern church (left foreground), school buildings behind it and tall apartment houses for 850 families (background). All garages will be underground.



VENTED SMOKE. This pocket gadget puts a ring of air holes in a cigarette to ventilate it as you draw, makes it burn longer and, says inventor Anthony P. Miller of Atlantic City, reduces the formation of tars by reducing heat. You place the cigarette—either a filter or non-filter type—in the cylinder, pull out the plunger, push it back in and, presto!—built-in air conditioning.



SPARROW WITH BIG STING. A split second after firing, a Sparrow III, newest Navy supersonic guided missile, streaks toward its target. Recently made operational with the Seventh Fleet in the Pacific, the deadly air-to-air weapon packs 50 percent more wallop than its predecessor.

BOY-SIZE IGLOO. Semi-transparent walls of this fiberglass igloo admit light, provide good insulation, make it suitable for all-weather outdoor playing. A garden hose will clean it inside and out. The maker is D-C Reinforced Plastics Co., Denver.

RED-LIGHT BEATER. A car's speed is electronically measured as its wheels cross these twin channels—to hold the green signal and let the car get by. The system is being tested in London.

DRY-FOOT BOAT. Built like an LST, the British boat at right has a hinged bow that drops down to serve as a gangplank. It lets passengers land on a beach or muddy bank without getting their feet wet; avoids clambering aboard over the gunwales.

5 Ways to Lick That Tired Feeling

2 Look energetic. You model your actions on your mental image of yourself. So make the image a successful one: erect and neatly dressed; firm voice; plenty of healthy bounce.

4 Plan ahead. You get more accomplished with less effort if you budget your time—in writing. But don't set up an overly rigid timetable; you may waste energy keeping it.

Tire too easily? New discoveries show you how to tap stores of energy you didn't know you had

By John Kord Lagemann

IF YOU poop out too early, maybe you need vitamins. But maybe you just need to know the tricks of getting full use of the energy you have.

Today, scientists understand what makes you tired: why you *think* you're all played out when there is still plenty of get-up-and-go left in your machinery. You can use their findings to beat that tired feeling and get more done on the job or around the house—or just have more fun out of life

What the scientists learned about fatigue is this:

- When you get tired, it's your brain

1 Keep healthy. Get the right amount of food and rest—too much is as bad as too little. Since fatigue may warn of illness, schedule a regular medical and eye examination.

3 Think positively. Firm belief in your ability to do what you want to do helps you do it. But don't kid yourself—face your limitations and try realistically to overcome them.

5 Know your goals. Set definite—and reasonable—aims for yourself so that you can gauge your achievements. You'll advance from one to the next faster—and with less fatigue.

and not your body that says, "I've had enough."

• Two different signals can flash the tired sign in your brain. One is chemicals in your bloodstream, the waste products of exertion. This causes the healthy tiredness you feel after strenuous activity. The other signal is emotional. This causes the nervous exhaustion that overcomes you even when you've done no work.

• Both kinds of fatigue were designed by nature to serve a useful purpose. But sometimes the signals go haywire and have to be reset. And this, it turns out, is not hard to do.

How tired is tired?

Long before Roger Bannister beat the four-minute mile, Dr. Robert S. Schwab predicted it would be done. It was no rash speculation. Dr. Schwab and his

WHEN ARE YOU EXHAUSTED? It depends. Just for fun, a man can hold himself up one minute. But if there's a bet, he sticks it out for two.

staff of the Brainwave Laboratory at the Massachusetts General Hospital in Boston measured energy fluctuations in nerves, muscles and brain cells. They discovered that the brain says, "I can't," before the muscles use up all their energy. They had actually tested runners who fell exhausted. The athletes' legs still had plentiful reserves of energy.

Why didn't they go on using it? As muscles burn fuel, the "ashes"—lactic acid and carbon dioxide—are dumped into the blood. A certain concentration of these chemicals signals the brain to call it quits.

This is a vital safety device. A muscle that runs out of fuel completely takes 10 to 15 minutes to recover. Dr. Schwab points out, "You can't wait that long for an exhausted lung or heart muscle to start working again."

But nature's margin of safety is extravagantly wide. You could ignore the "out-of-fuel" warning signal (assuming your heart is okay) and exert your muscles much harder than you do. In fact, your brain itself holds back the signal when you're under stress. You can even force your brain to do that by convincing yourself that continued exertion is essential.

Dr. Schwab often demonstrates this. He points to a horizontal bar in the doorway of his office.

"How long can you hang by your hands?"

Ordinarily, an adult holds on for about one minute. If Dr. Schwab exhorts him to do his best, he sticks on an extra half-minute. The offer of a five-dollar bill adds another half-minute.

"Nobody knows how long they'd hang on," says Dr. Schwab, "if I offered them a thousand dollars or if I pushed a vat of sulfuric acid beneath them."

Fatigue can cover up for you

But sometimes you get tired before you do anything. You're licked before you start. This is what doctors call nervous fatigue. It is not caused by physical exertion but by mental conflict. Yet there are ways to outsmart this kind of tiredness, too.

The most thorough recent research on nervous fatigue was carried out for the Navy by Dr. Harley C. Shands of the University of Virginia Medical School and Dr. Jacob E. Finesinger of the University of Maryland Medical School. Their study shows it to be a protective device that has gone berserk.

"Chronic fatigue occurs whenever a person feels rejected, frightened or angry, in circumstances which prevent any expression of these feelings," report Dr. Shands and Dr. Finesinger. The only way to overcome this kind of fatigue is to uncover and control the hidden feelings that are being blocked by the fatigue.

Suppose you're on a plane. The weather is fine and the passengers are actively talking and reading. Then you run into foul weather. Conversation falters. Many passengers slump in their seats. There is a good deal of yawning.

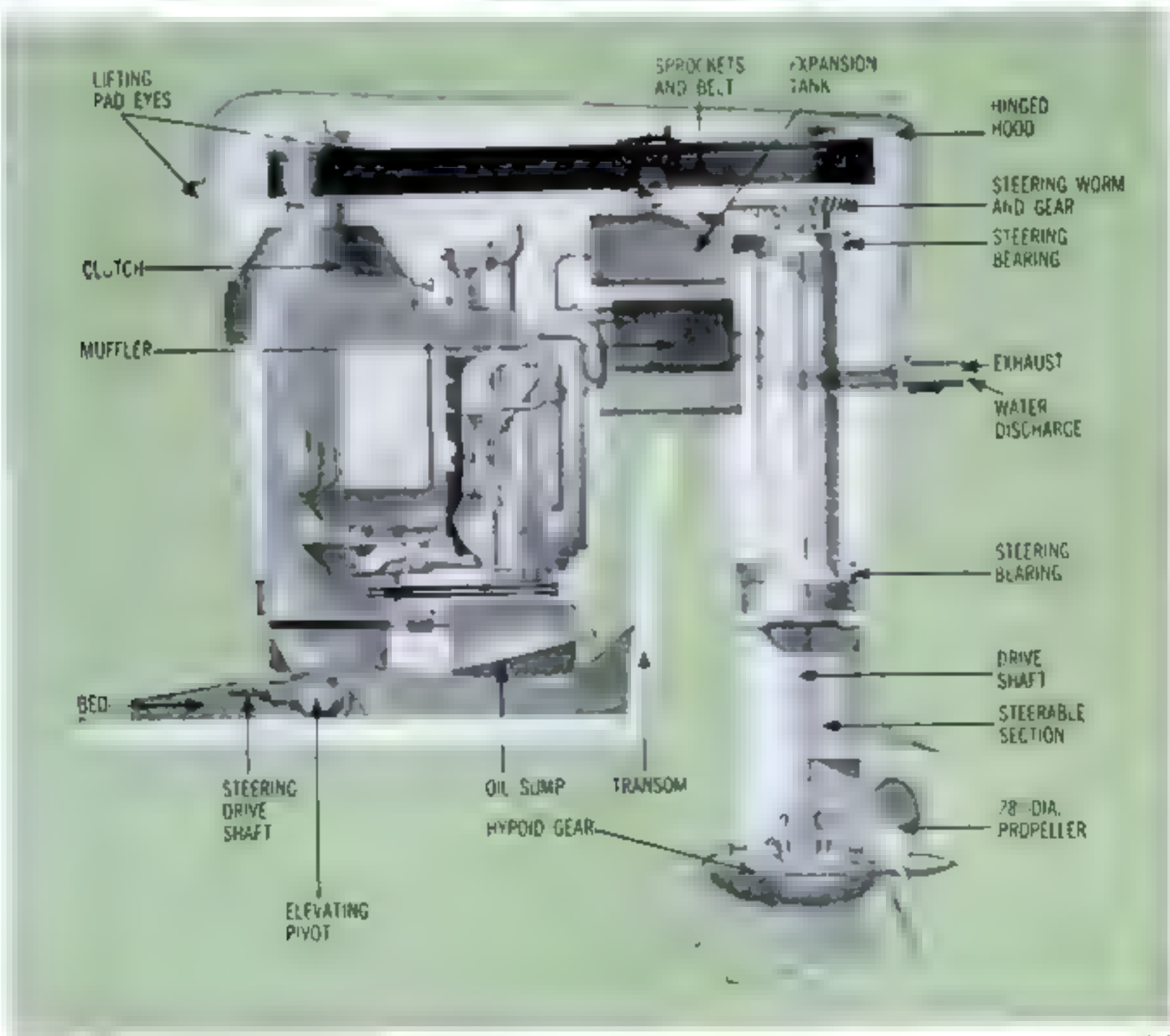
Here is the basic condition that brings on nervous fatigue—a problem that you can neither fight nor flee. The alarm brought on by bad weather keeps prodding you: "Do something." But to follow this impulse would lead you to useless and socially unacceptable behavior such as shouting or running up and down the aisle. Listlessness and yawning resolve this conflict by saying in effect, "You see, you don't have to worry. There's nothing you can do. You're too tired."

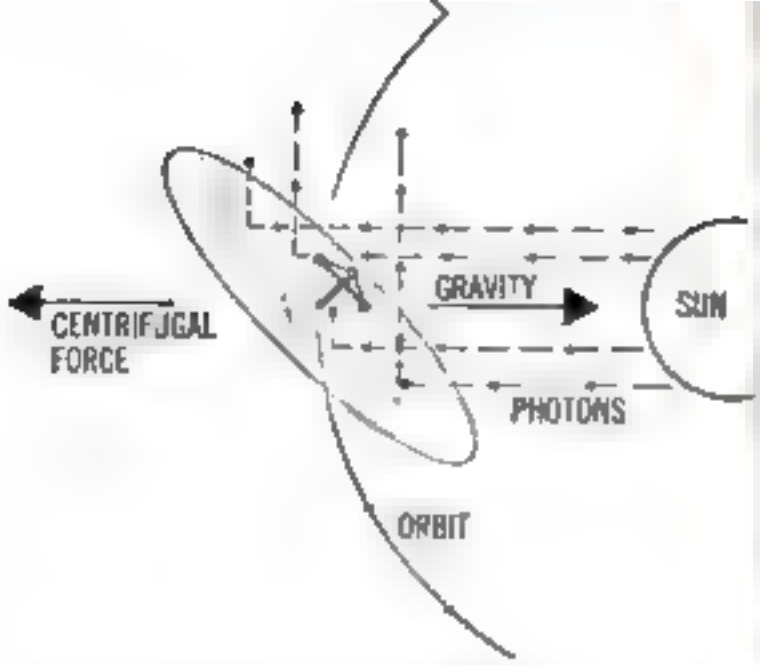
Up front in the cockpit, things are different. The bad weather also alarms the crew. But instead of getting tired, they become more wide awake. There is something they can do. It is only after landing safely that they feel tired.

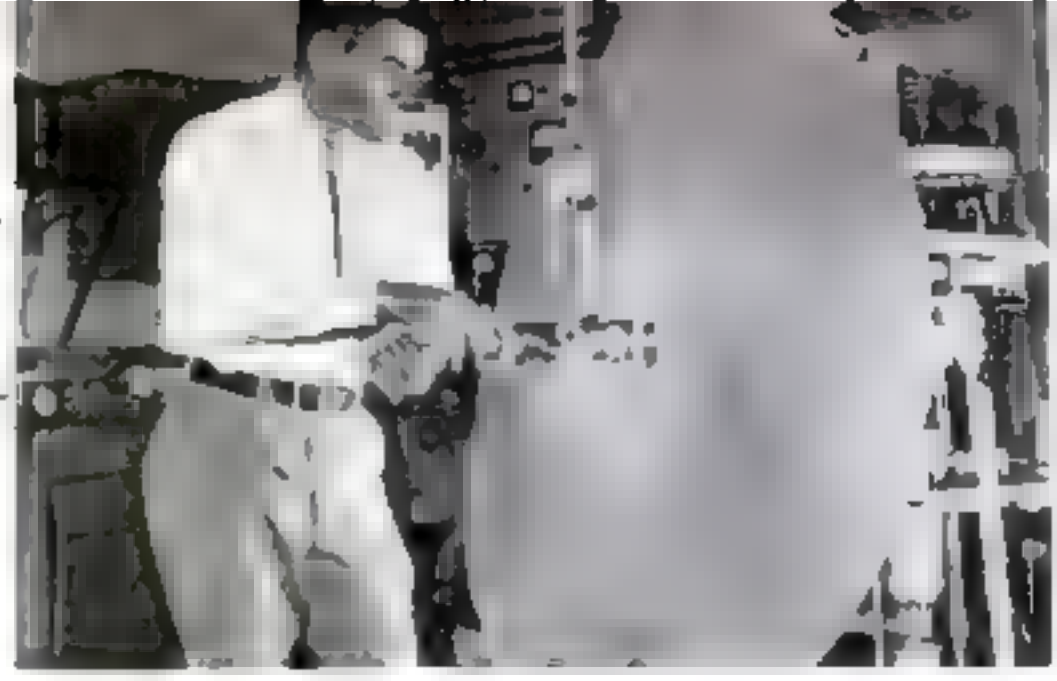
[Continued on page 244]

Diesel Outboard Weighs 1½ Tons

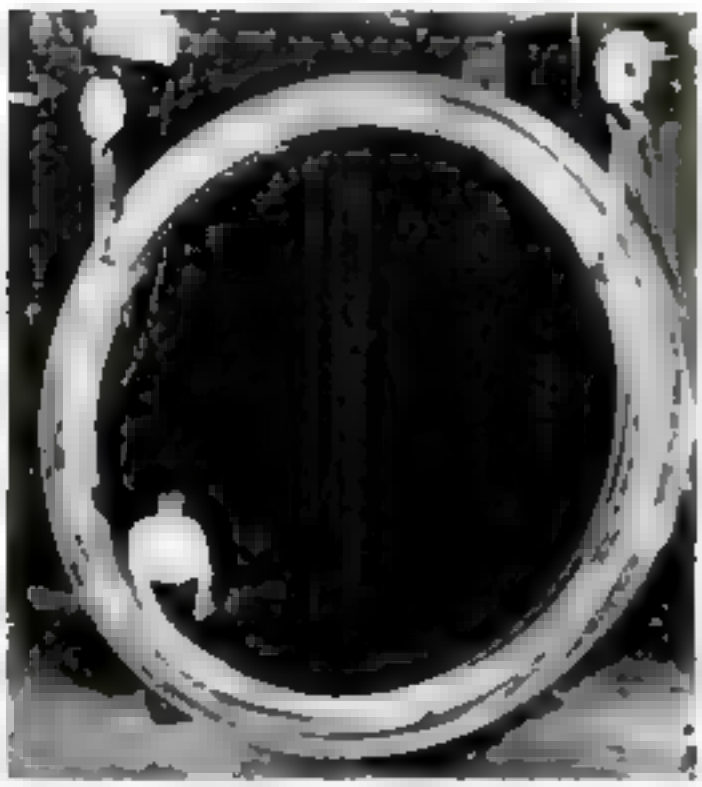
THE Diesel-Cruisemaster is designed to power cruisers 28 feet long and up. A 97-hp., three-cylinder, two-cycle engine sits on end on the boat's floor and drives the propeller through a belt and shafting. To steer, you rotate the lower section of the drive unit. The propeller can turn 360 degrees. Turning it 180 pulls the boat astern. Murray & Tregurtha developed the Cruisemaster with GM Diesel. Price: about $5,000.





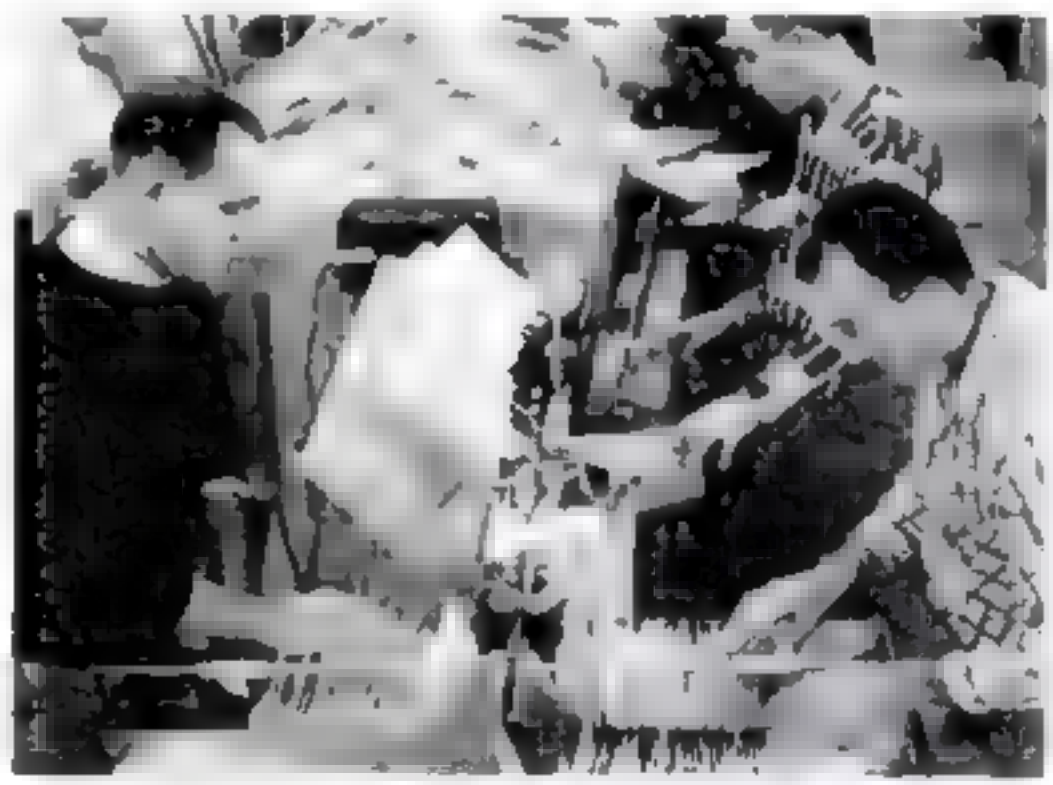


SAILING SPACESHIP. Unfurled in space, a huge aluminum-coated disk of plastic would become a solar sail, and harness the pressure of sunlight to propel a spaceship, say Los Alamos scientists who built this model. The sail, a quarter mile across, would open when its 1,000-pound rocket carrier reached earth-orbiting position. Then, riding on the sunbeams, which exert a motive force of about 1/100 of a pound per acre of reflecting surface, the solar ship could cock its sail for a round trip to Mars.

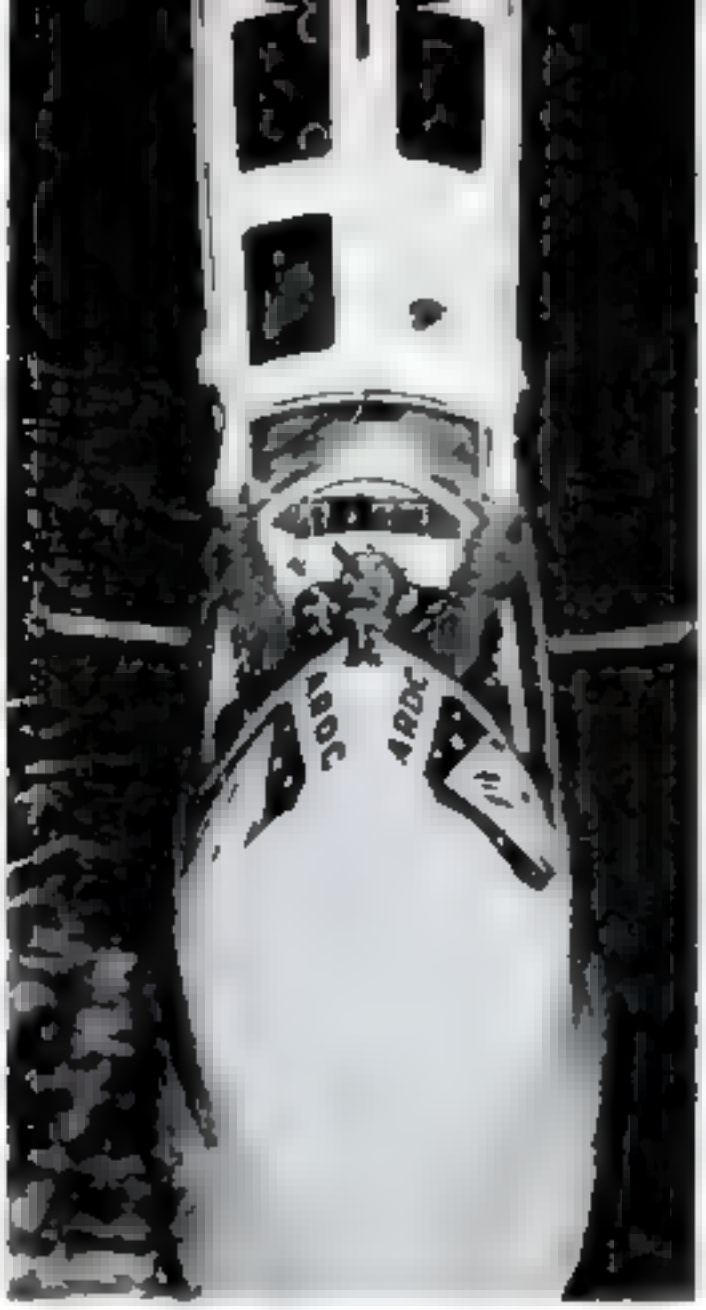


GIANT BALL BEARING. Inside this race, 13 feet nine inches in diameter, are 88 four-inch steel balls. The huge unit was designed by Kaydon Engineering, Muskegon, Mich., for use in the pedestal of the radar system for a Nike-Zeus ground-to-air missile.

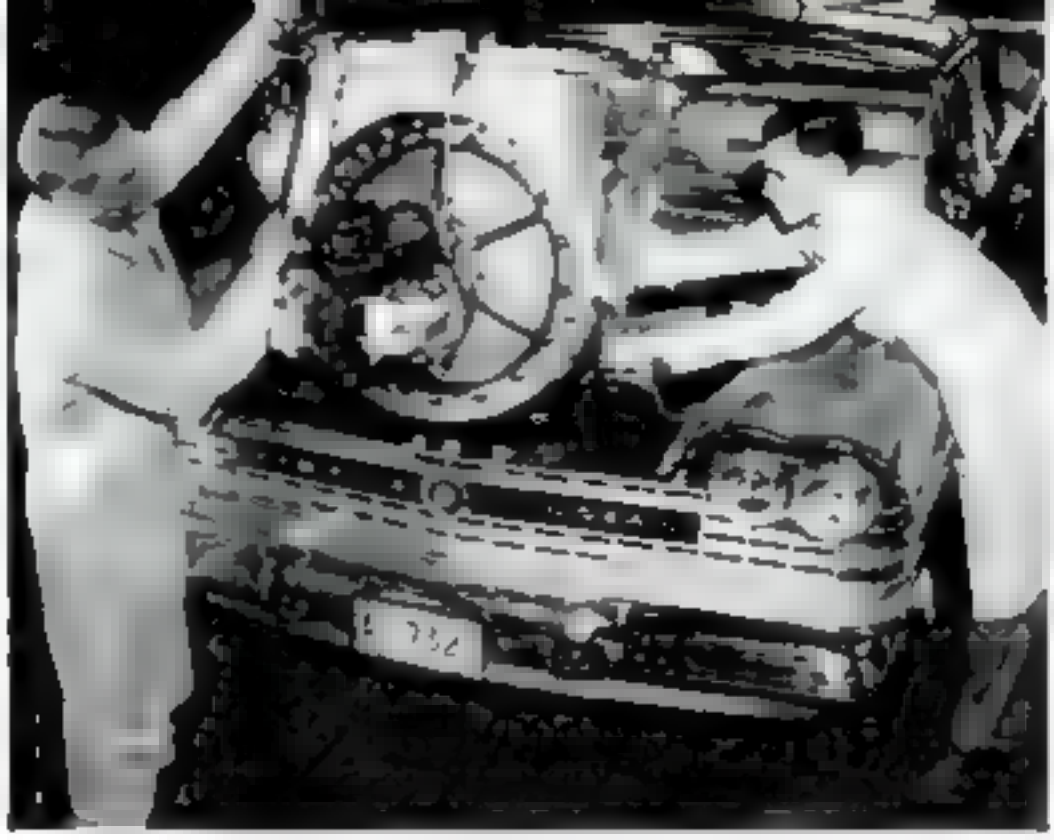
FASTEST JETLINER. Now undergoing flight test, the 615-m.p.h., medium-range Convair 880 will be the world's fastest when it goes into service early next year. In a two-abreast luxury seating version it will accommodate 88 passengers.



SPEEDS MAIL. Mixed mail (batch on table in background) is lined up uniformly for postmarking and stamp cancellation (called "facing") by this automatic machine being adopted by the U. S. Post Office. An electronic eye recognizes adhesive stamps and triggers the positioning mechanism of the unit.

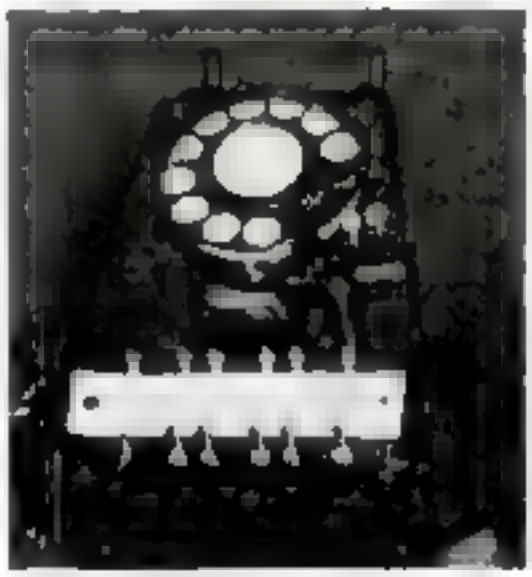


ESCAPE CAPSULE. This 12-foot sealed boat is intended by the Air Research and Development Command for the rescue of supersonic pilots down at sea. Its survival kit contains a powerful radio, emergency food and water for 72 hours or longer.



GAS TURBINE. Chrysler's latest experimental gas-turbine engine is lowered here into a 1959 Plymouth test car. On a 576-mile economy run, it averaged 19.39 miles per gallon at 38 m.p.h. on diesel oil, turbojet fuel and unleaded gasoline.

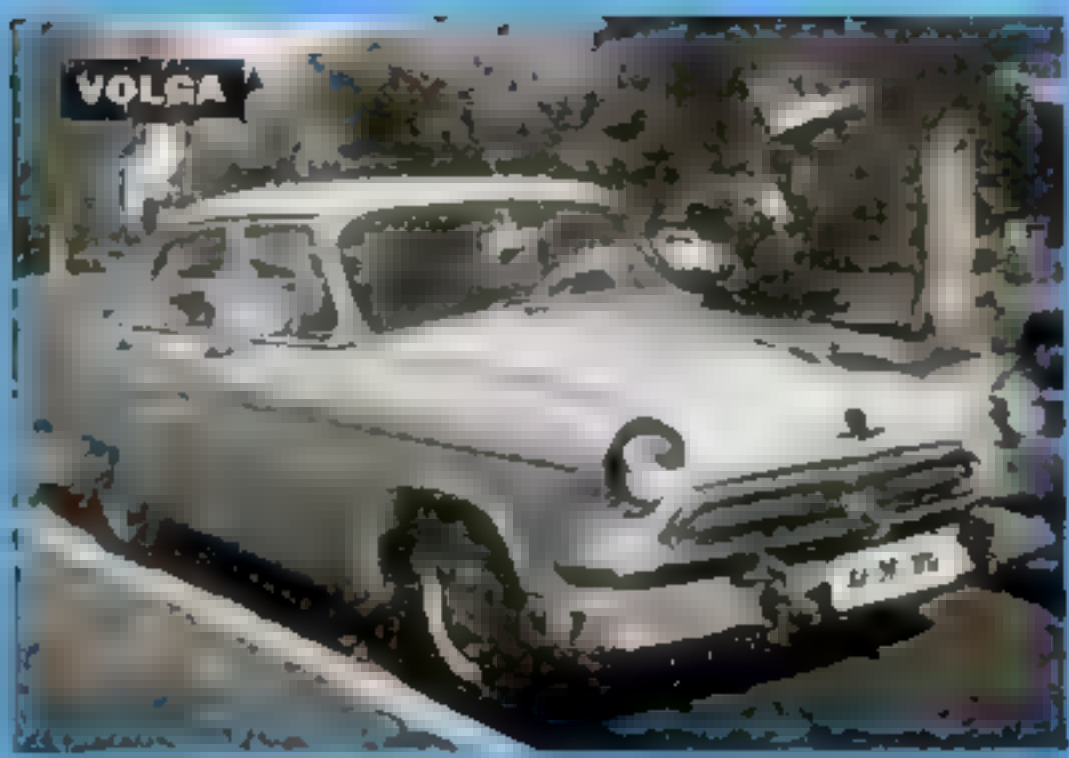
MAGIC DIAL. Set a number by dialing the telephone at right, and you can get it later by pushing one of its buttons. Models made to remember up to 100 numbers have been tested in Belgium and Switzerland where they will soon go into use.



NO-ICE ICE SKATES. Rubber rollers in a single row on the German skates above act as blades, make them useful for small fry learning to ice skate at home. They won't mark the floor.

ATOMIC BEEHIVE. This 87-foot-high aluminum-sheathed concrete dome houses a 5,000,000-watt nuclear reactor at Plainsboro, N.J. Operated by 10 firms, it's the largest privately owned reactor.

Russia's Small Cars:



Little Moskvitch, bigger Volga are sluggish but surprisingly like U. S. cars in trappings

RUSSIAN cars are as rare as rubles in the U. S., so I was extraordinarily pleased to get a chance to look at and drive a low-priced pair of them the other day in Los Angeles.

One was the little Moskvitch, which is precisely the same length (13 feet, three inches) as the familiar Volkswagen sedan. The other was a Volga, which is somewhat bigger (15 feet, eight inches) and definitely fancier. Both are four-cylinder cars. On these pages, you can see how they look.

They are cars that a Russian with a middle-size income is most likely to buy, when production permits. They are not for sale in the U. S., but were brought here by Stanley Slotkin, a Los Angeles businessman and importer, as interesting curiosities, which he put on display to help raise money for the March of Dimes.

For Russians, who pay 8,000 rubles for the four-passenger Moskvitch and 16,000 rubles for the five-passenger Volga (official rate: four rubles to the dollar), the cars are not cheap. For tourists, with the advantage of their special rate of 10 rubles to the dollar, they are alluringly inexpensive. Outside Russia, the cost drops even farther. Because of trade-war conditions, the Volga has sold in some countries for as little as $530. Slotkin, on the basis of his own experience, esti-

Stylish but Lazy

mates that shipping costs, import duties, excise taxes, and distributor and dealer profits would raise the Moskvitch's price to $1,200 and the Volga's to $1,750 if they could be bought in the U. S.

Each car has a standard transmission, with the gearshift lever on the steering post. Both have four doors and two seats. The seats have the stiff, taut-spring feeling that my grandmother's horsehair sofa had but they make up into beds.

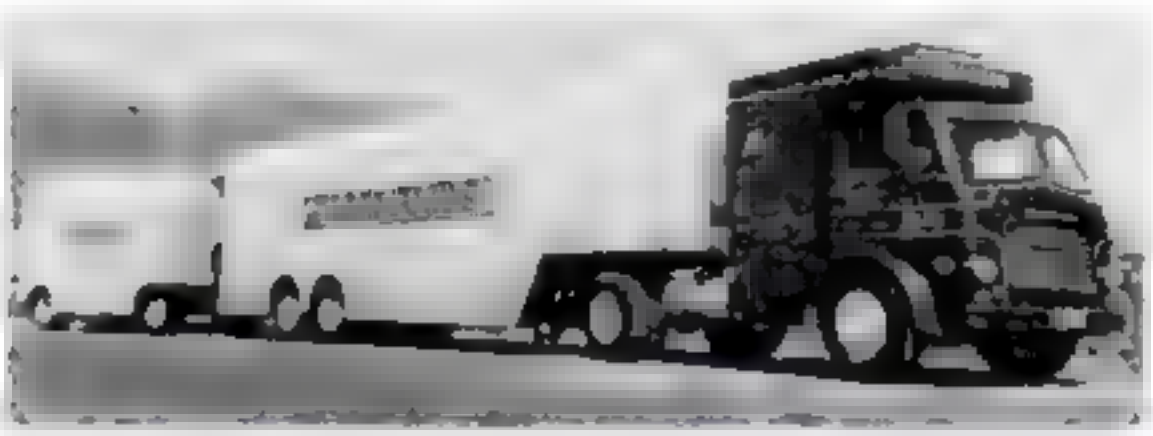
I was more impressed by the appearance of the Moskvitch and the Volga than by their performance. The 35-hp., 2,160-lb. Moskvitch is frankly lazy. The 80-hp., 3,218-lb. Volga, though smoother and brisker, is still no gazelle.

All the comforts. But they are remarkably like U. S. cars in their accessories and controls. They have radios and heaters, ignition-key starters, American-type turn indicators and windshield defrosters, dome lights, sun visors and glove compartments, floor buttons to switch headlight beams, and pull-releases under their dashes to unlatch the hoods. The last, in both cars, is at the far right of the cockpit, well out of the driver's easy reach. Ivan had better have Natasha ride with him

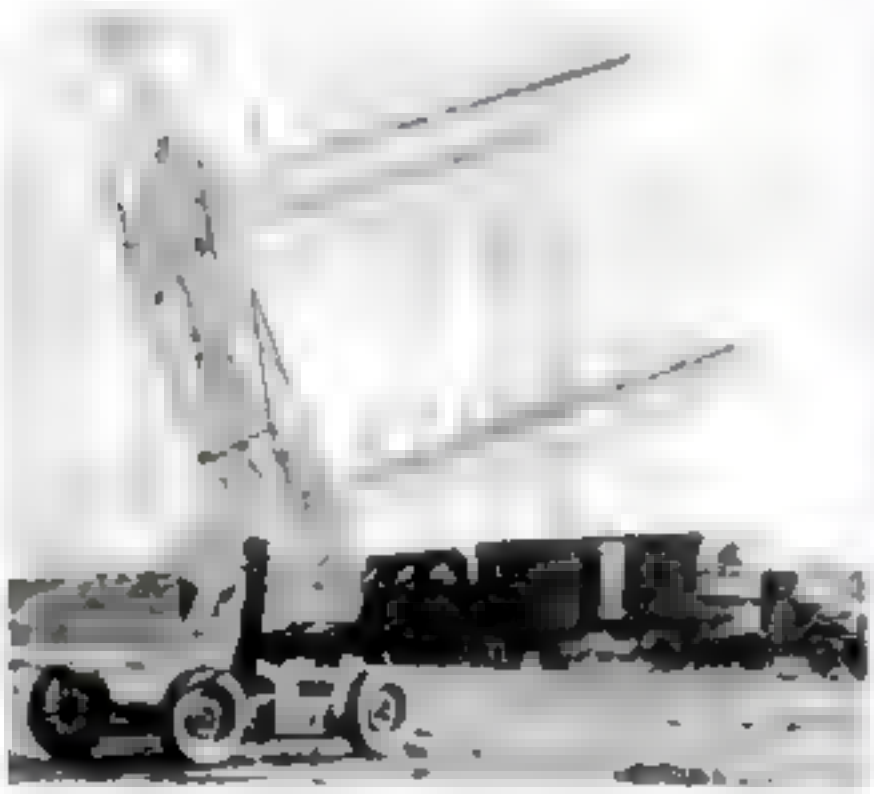
Unlike American cars, the Moskvitch and Volga come equipped with a crank for emergency starting, two bags of tools, a tire pump, a flashlight and a spare set of radio tubes. Each car also has two huge maintenance manuals, one in Russian and the other in English (with ex-

[*Continued on page 240*]

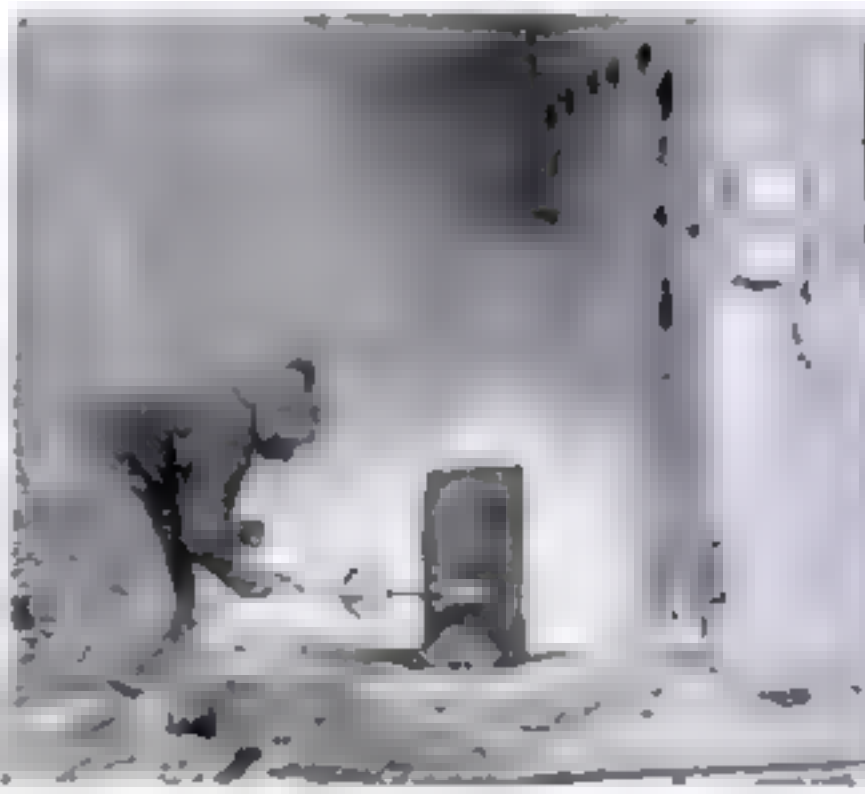
SPIKED TIRES. Special steel wedges sunk into the treads of racing-car tires (above, right) are one way to help tame skids even on a treacherous track. They were used by drivers in the first European Grand Prix on ice (left) run last winter over the course at Cortina d'Ampezzo, Italy.



TANDEM TRAILERS. For long-distance moving in South Africa, a Cape Town hauler uses this giant road train. It carries 16-ton loads on trips of 1,500 miles or more. Tractor and two aluminum trailers make up a train over 60 feet long.



SATELLITE MOUTHPIECE. Antennas like this one at Fort Stewart, Ga., sent messages to and received them from the Atlas missile in orbit about the earth. The mobile unit is controlled from the station van in the background.



HOT LANCE. Intense heat—nearly 10,000 degrees—melts through a 1½-foot concrete wall (above) at Hill Air Force Base in Utah. The iron-pipe lance, consumed by its own heat, is replaceable. It does two weeks' work in a day.

GOING UP. There was not enough space between two adjacent houses to slide this five-room home between them, so Los Angeles house movers made the hard way the easy way. They jacked it high on stilts and took it over the top. The job required two days and cost $1,650.

FLYING BLIND. To make their rest easier and more complete, passengers on all Air France long-distance flights are now given sleeping masks. They shut out light, enable weary travelers to nap as they lean back in reclining seats.

TEAMWORK. With a flight deck on the fantail, the destroyer Everett F. Larson and a helicopter are paired to counter submarines. When sonar picks up an enemy sub, the chopper is sent with depth charges to strike before it's aware.

DO-IT-YOURSELF TICKET. New pushbutton machines allow passengers on the Cleveland, Ohio, transit system to print their own transfers. During rush hours the jamproof automatic printer can issue 60 tickets a minute.

You're in trouble if you try to obey sign at this point

To turn left from right lane here, on U. S. 1 near New Brunswick, N. J., is sure suicide in pell-mell traffic. Confusing sign means only at crossroads.

Stupid Traffic Rules make law violators of sensible drivers and actually increase auto accidents

By Edward D. Fales

An example of bad timing

Once a minute, this light on U. S. 13 near Marcus Hook, Pa., turns red, halting main traffic even though very few cars use the side road.

Misleading one-way arrow

This sign in Media, Pa., could cause a wreck. It seems to indicate a one-way street, but it really marks the entrance to a gas station.

Would you pass here?

A blind hilltop curve lies just ahead on High Ridge Road outside Pound Ridge, N. Y. yet the road is marked (broken line) for safe passing. Such errors invite disaster

Can you find a signal?

Bill Toth parks along U. S. 22 south of King of Prussia, Pa., to hunt for a traffic light at a crossroads. In a jungle of signs, you may need a magnifying glass to find it

HAVE you ever been blamed (or arrested) for a highway tangle that you honestly felt was not your fault? Have you ever broken a speed law because you *knew* the limit was too low?

You have, of course, if you're like most drivers. And you may well have been in the right.

Traffic experts are beginning to point out that danger lurks in such things as faulty speed limits, bad signs and inept left-turn regulations. The other day, Frederick W. Hurd, a top U. S. engineer and head of Yale's Bureau of Highway Traffic, warned that "unrealistic controls" (1) turn good drivers into lawbreakers and (2) make them drive dangerously.

And in Washington, D. C., Donald S. Buck, the Army's deputy safety director, came to the defense of well-intentioned drivers who, he says, are often blamed when the real fault lies with the way we run our roads. Says Buck (a former Indiana trooper and one of the savviest men in traffic):

"Everybody points a finger of scorn at the driver: police, educators, officials, researchers and our highway engineers. The driver *can't* win. He's always at fault. He's damned as (1) stupid, (2) reckless, (3) selfish, and (4) careless. He's told he 'gets a feeling of power over others' when he's behind his wheel."

In Chicago one day, Buck was bawled out by a cop for doing *only* 35 m.p.h., which happened to be the posted speed limit. Yet, on the same street, a few hours later, Buck saw a driver pinched for doing 40.

This started Buck thinking. Another day, on a fast road in Virginia, he saw a sign at a railroad crossing. It said, "SLOW TO 5 M.P.H. STATE LAW." He obeyed the law. Cars behind him screeched and skidded. A police car rushed up.

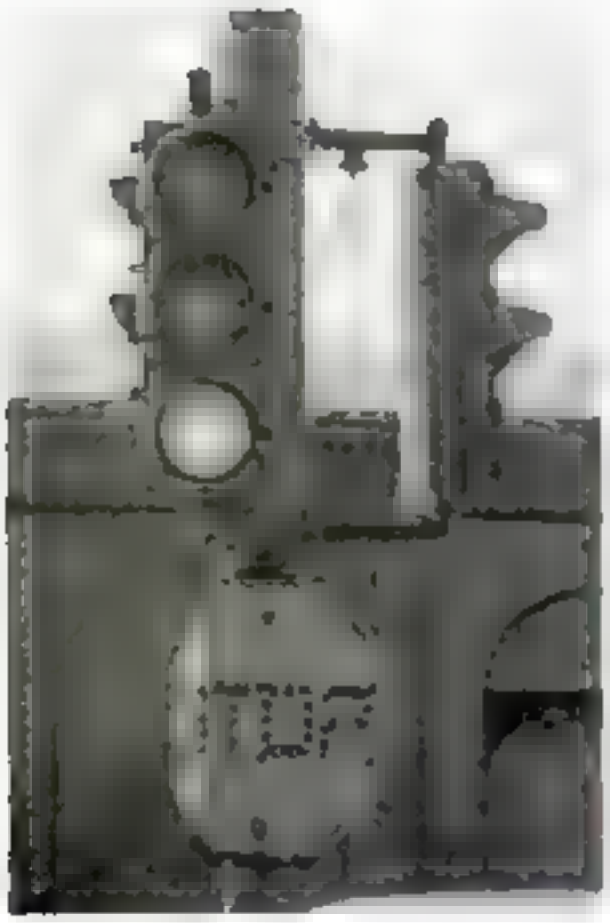
"Don't you ever do that again," thundered The Law.

"But, Officer," said Buck, "I was only obeying the sign."

Who's to blame? Since then, he has traveled all over the U. S. collecting a list of hazards forced on motorists by foolish laws, lights, rules, signs and engineering. His study suggests that many of the sudden risks you run on today's roads are *the fault of men (often untrained) who are paid to make your roads safe—and who are the drivers' worst critics.*

For example:

- How often do you come to curves



Empty—but still snail-paced

It's Sunday on deserted U. S. 13 outside Marcus Hook, Pa., yet an inflexible 30-m.p.h. limit invites lawbreaking.

Which one would you obey?

This light (left) in Wilmington, Del., is green, but the beat-up sign says STOP. If you hesitate, you may be hit.

marked (usually with a broken center line) for safe passing when you *know* passing can be suicide?

• How often do you slam on your brakes because someone has timed a traffic light to change too fast?

• And how often do you find a big yellow school bus dangerously loading children at a bus stop recklessly located just around a blind curve?

"The average motorist," says Buck, "survives in *spite* of such hazards. He does a terrific job, obeys all reasonable laws—and gets no credit."

To see at first hand what Buck and Hurd are talking about, I recently drove from New Haven to Washington, through six Eastern states.

With me, for two days, rode William Toth, of the New York University Safety Center. We traveled in two cars, my Rambler and Bill's Thunderbird.

The silly signs. In our travels, we found signs that couldn't be read, arrows that appeared to point the wrong way, signs that lied ("MEN AT WORK" when nobody was working, "ROAD LEGALLY CLOSED" when obviously it was legal to use it, and "SPEED 40 M.P.H." when patrols were nudging traffic along at 50). We found traffic signals where none were necessary, stop signs that actually made

Why all those skid marks?

Here's vivid proof that hundreds of vehicles on fast U. S. 1 in Metuchen, N. J., have braked hard at a foolishly fast-changing signal light.

No wonder drivers wander

When guideposts are partly hidden, like this one on U. S. 22 in Highland Park, N. J., confused drivers may easily get into traffic trouble.

A fast downhill curve, and doom perhaps seconds away

Hidden below the hill, on U. S. 22 south of King of Prussia, Pa., is a "sudden death" traffic signal, yet warning sign is where it can't easily be seen.

it more hazardous to enter a main road, left turns that could have made our cars sitting ducks in fast traffic, and signs and signals that simply confused us.

In New Jersey, Bill and I cut over from the Turnpike—a fine road, well run—to U. S. 1. Traffic: roaring. Speed limit: 50 m.p.h. This meant that the police were probably tolerating 55 for anybody driving properly (as most drivers were).

Suddenly, at Main St., Metuchen, the traffic signal flashed yellow. I slammed on my brakes and counted . . . In exactly five seconds, the signal flashed red. In that breathless interval, all those tons of cars and trucks thundering down U. S. 1 were expected to stop. They'd *better* stop, because cars instantly began whipping in from the side road.

We got out and watched that light awhile. U. S. 1 was scarred with skid marks for hundreds of feet back. Each skid meant an emergency—thrown at motorists by the way that light was timed. Yet a five-second amber is common all over America.

Bill Toth and I drove off U. S. 1 into Highland Park, N. J. There, in the 25-m.p.h. business district, we timed the lights. They changed from red to green in five seconds.

"Exactly the same warning that high-speed traffic gets on U. S. 1," Toth commented, shaking his head.

Crossing the Delaware. Darkness caught us in Trenton. And there, trying to follow little, hard-to-see signs, we got lost. Getting across the Delaware, we had more trouble than George Washington, but we finally made it and found ourselves trailing three cars up a hill on Route 422 near Norristown, Pa.

Suddenly: *Slam on your brakes. Quick!* Over the hill, with no warning, one of those maddening sudden-death traffic signals glared at us like an evil eye. The "stupid drivers" ahead managed to stop—and we did, too, but so abruptly that another car, breasting the hill behind us, had to pull to the right shoulder to keep from hitting the T-bird.

Let me stress: We were doing no bumper-chasing on this trip. We were driving with all the caution at our command. We went back over that hill and tried it

One car stops traffic twice

This car tripped a treadle to cross U. S. 22 in Media, Pa.; now halts traffic again by tripping a badly placed treadle on the other side.

again. You go over the top and there—with only seven seconds to stop—is Old Evil Eye. But the worst of it is those hidden stopped cars, lined up and cutting your margin down to perhaps three or four seconds.

After the five-second light on U. S. 1, this one might have seemed easy. But when you hit your brakes, you're already rolling downhill fast—so you need extra stopping time.

What you do here if there's rain—or a little ice—Toth and I never did figure out.

Next morning, near King of Prussia, Pa., we came to one of those STOP signs that can be seen only if you hunt through the bushes long enough. We came out of a side road and there it was—hidden, until the last instant, by overhanging shrubbery.

How anyone can get out into Route 22 safely from this sign when fast traffic is coming is a mystery. The sign is planted 28 feet back from the highway (Bill got out and measured it). If you stop where the sign says to stop, you can see down Route 22 to your left just fine—but on your right you're looking into a small jungle.

Keeping Pennsylvania safe? South on U.S 22 is a huge billboard that says, "Let's Keep Pennsylvania the Safe Driver State." Less than a quarter-mile away is another of those sudden-death traffic lights, hidden around a curve at the bottom of a hill. You have six seconds to negotiate a safe stop on dry macadam, water or ice.

Bill Toth read the big safety sign again. "They should have spent their money to put up a big sign saying, 'DANGEROUS INTERSECTION AHEAD. PREPARE TO STOP.' "

Sure, there was a warning sign that read, "SIGNALS AHEAD." But it was all of four feet high, way over beyond the right shoulder, while your eyes were watching that curve to your left. After a snowstorm, it would be hidden in drifts.

Now and then, we saw traffic lights that were broken and not working. If you have a collision at such an intersection, it's usually your fault. But here's a tip: In one state a while ago, the courts found that local police had been passing a dead signal for hours without reporting it out of order. A collision occurred. The court held that neither driver was to blame and that both could sue the state!

In Wilmington, Del., we found a puzzler that may sound familiar to you. At a busy corner, on a pole, was a green traffic signal. We started through. Only then did we see a beat-up STOP sign—on the same pole. *Now* what do you do?

Most drivers (you've had the experience) hesitate, hit their brakes in slight panic, then figure it out: "The stop sign must mean what it says *only when the traffic signal is turned off.*" If, in that moment of hesitation, you get clobbered by the guy behind you (who is watching other cars and trying to be safe), you both may get a ticket. A couple of "foolish drivers," obviously.

I asked Toth about it. "Any thinking motorist could tell them what to do," he said. "Take down that stop sign and, if they don't want to use the traffic lights all night, fix the red signal so it blinks. A blinking red in most states now means: *Stop, then proceed if safe.*"

Making scofflaws. On the outskirts of Marcus Hook, Pa., we found one of those speed laws that make violators out of honest citizens. Location: a fine, wide boulevard on U. S. 13. Time: 10 a.m. on a Sunday. Traffic conditions: not a car in sight.

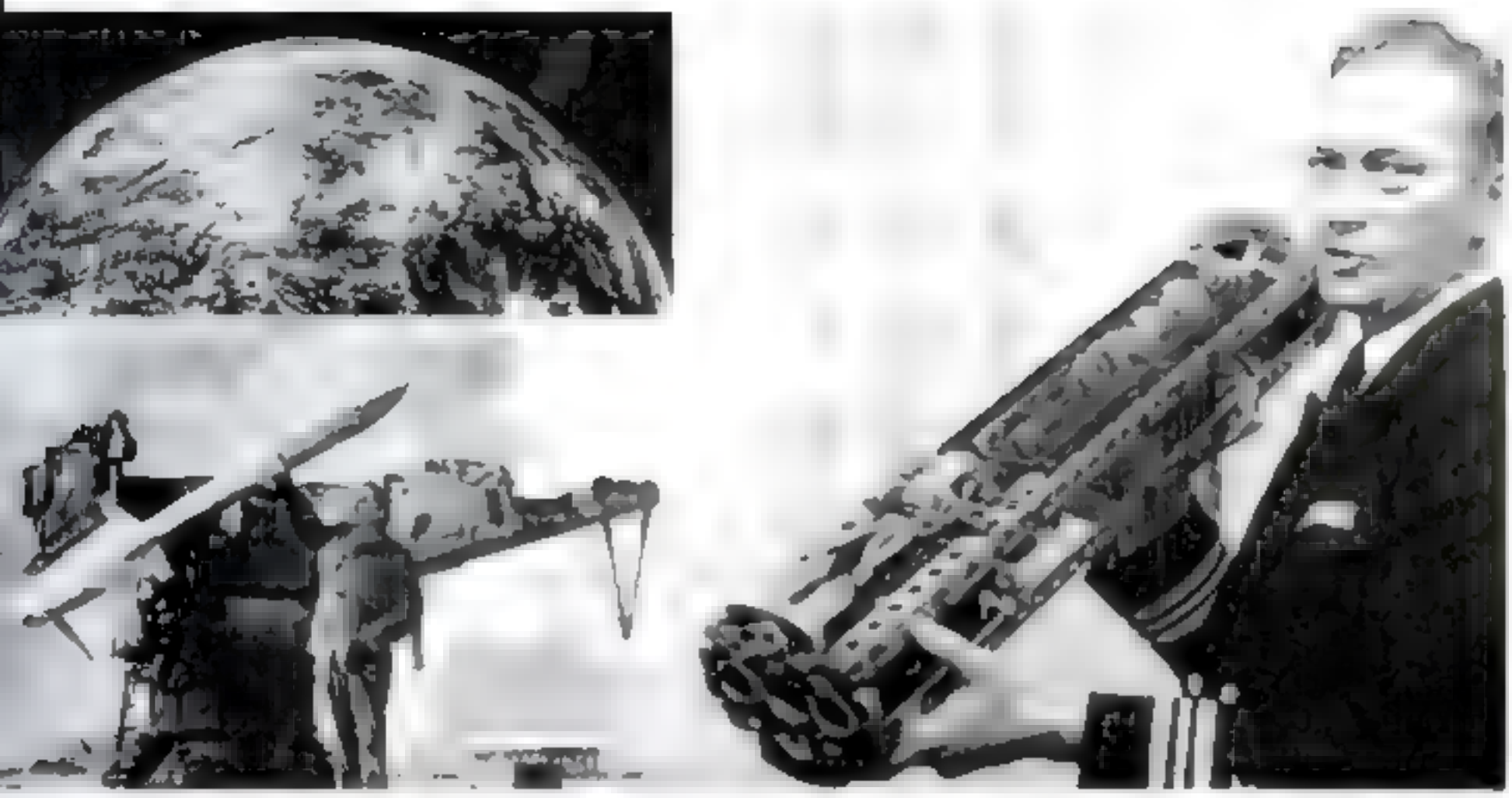
Four beautiful, empty lanes—and a speed limit of 30 m.p.h. Cars crept down the vacant boulevard, looking foolish.

You've come to such roads and wondered what to do. Perhaps you slow down and obey the law. Then you see

[Continued on page 248]

Where'd it come from?

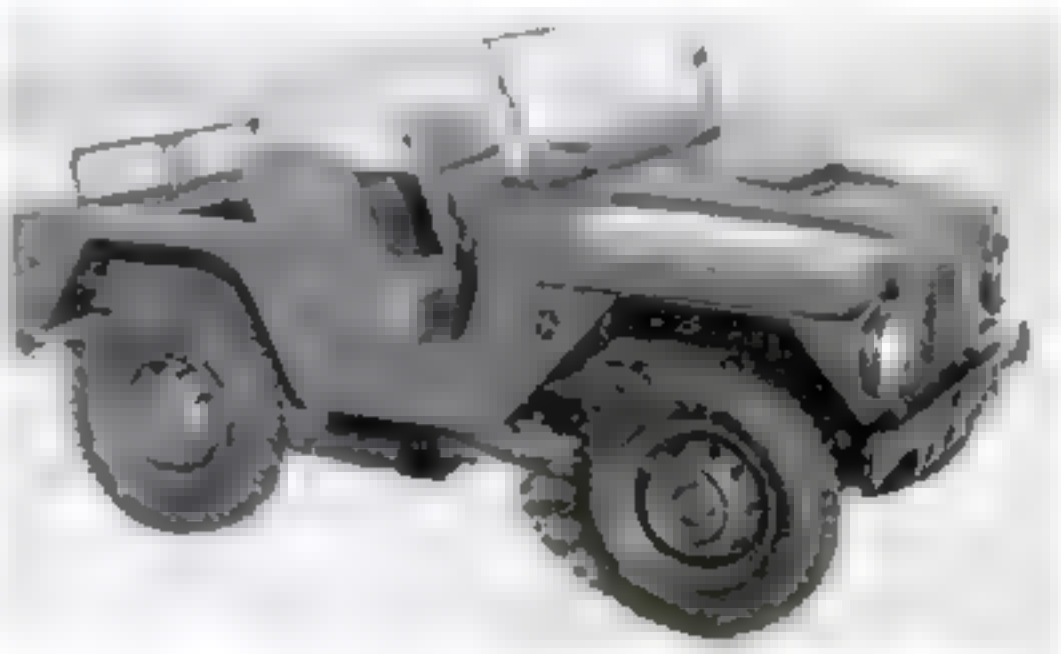
FATHOM: Dating at least as far back as Egyptian times, the fathom was the measure of a man's outstretched arms: 5, 5½, and now 6 feet in length. Because of its associations with sounding, or probing, it took on its familiar non-technical meaning. But not before its literal meaning acquired a romantic sense: to embrace!



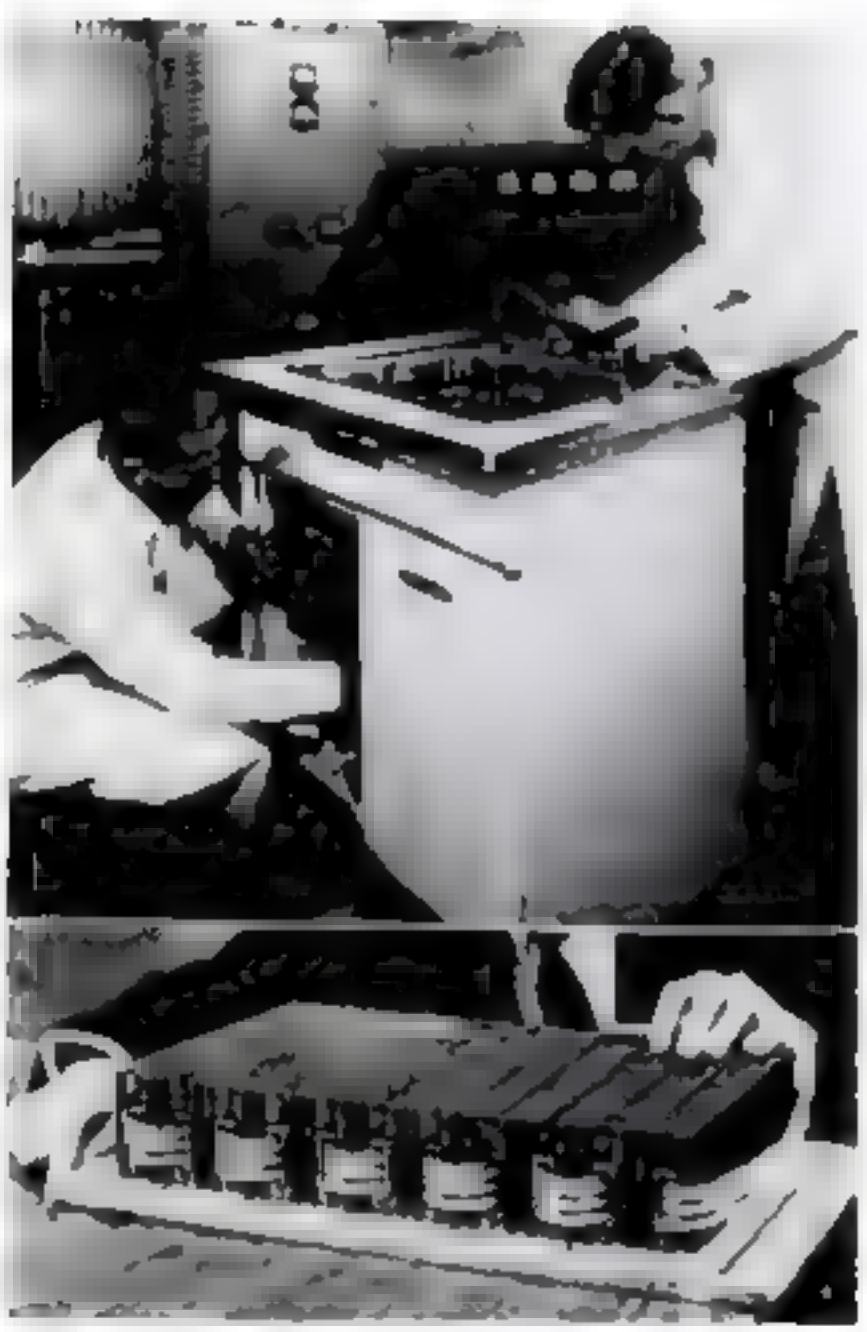
HURRICANE-SPOTTER. A movie-camera unit shot up 86 miles from Wallops Island, Va., in the rocket at left was recovered at sea after it had taken pictures of cloud formations from Florida to Maine. Navy and Weather Bureau expect the new technique to help give advance warning of tropical storms, such as the one shown at upper left in the photo-mosaic.

WATER JET. Engine of this British boat is an inverted U pipe, open at its two ends. A built-in pump sucks in water at the front, ejects it rearward to propel the craft through obstructed or shallow waters. Deflector vanes provide steering.

MIGHTY MITE. An air-cooled aluminum V-4 engine [PS, Feb.] powers this quarter-ton, four-wheel-drive vehicle being produced by American Motors for the Marines. The 1,700-pound car can be helicopter-lifted. It has a speed range from 2.5 to 62 m.p.h., can climb a 45-degree grade and ford water to a depth of 60 inches. The frame is of steel, the body of aluminum.



How Silent Sound Now Works for You



SINK THAT AUTOMATICALLY WASHES DISHES is a possibility. Experimental model has big electromagnet (lower photo) welded underneath to generate sound waves in water for cleaning. Other sound-wave dishwashers use sprays for rinsing, require conventional closed cabinets.

Washing dishes with sound is only the first of many uses for sonic magic in house and shop

SILENT sound, the strange power that can do everything from locating fish to welding aluminum, is now ready to work for you in your home. This year it's a brand-new kind of dishwasher—more effective and more convenient than present types. In years to come there'll be other sonic machines to lighten many ornery jobs around your house and shop.

Right now a sonic dishwasher stands waiting for the dishes in a model home in a suburban development outside New York City. This one, made by Narda Ultrasonics of Westbury, N. Y., should be on sale ($500) later in '59.

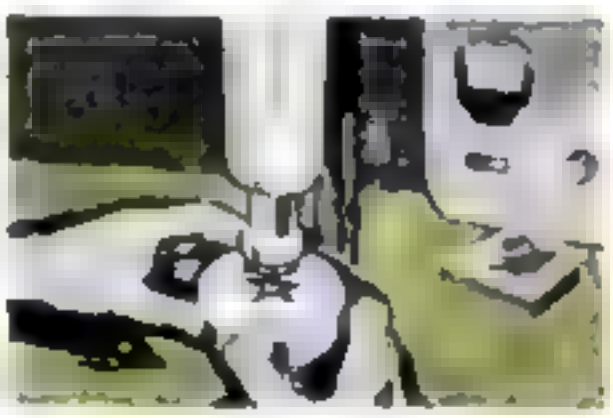
Another firm specializing in sound machines, Acoustica Associates of Mineola, N. Y., expects to have a similar dishwasher on the market by the end of this year. And Westinghouse has shown dealers a preliminary model that may be in salesrooms before many months.

All these machines look like regular dishwashers. The big thing is that they wash the dishes better.

- They're faster (six minutes for the whole job in Narda's washer).
- They clean pots and pans—even real

Many tough jobs are made easy by new sound machines

EASING PAIN. Doctors use very-high-frequency sound waves to treat patients with stubborn joint and muscle afflictions.



DRILLING HOLES. Sound generator "bit" vibrates abrasive to cut through hard materials. Hole copies shape of the bit.

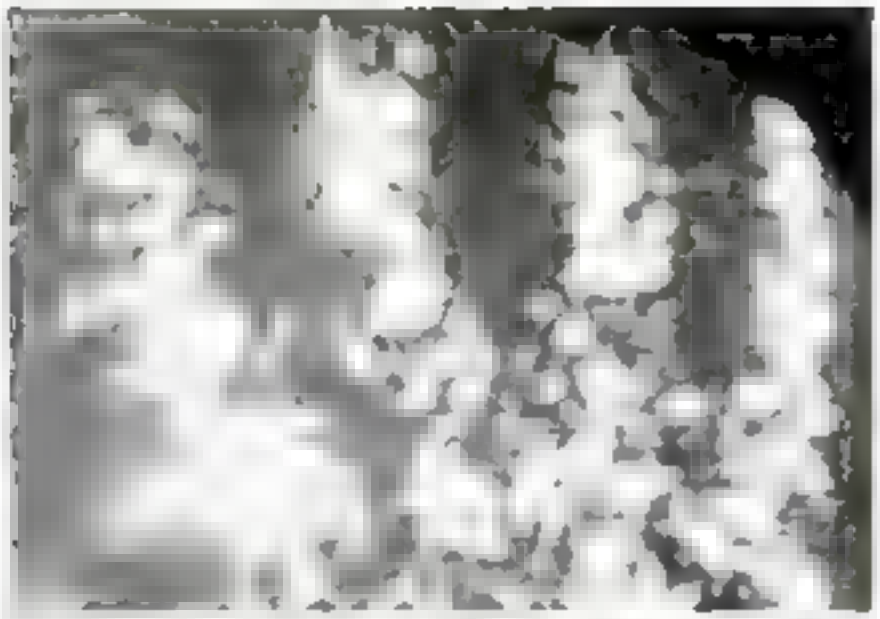
CLEARING FOG. Powerful sound from horns cuts chimney smoke, is now being tested as a landing aid for fog-bound airports.

Powerful sound blasts dirt off glass by exploding water into tiny bubbles. It tickles fingers.

CATCHING THIEVES. Alarm installed in museum detects anything crossing invisible, inaudible 'fence' of sound beams.

CHASING RATS. High-frequency sound, inaudible to men and other animals, bothers rats so [illegible]h they leave—permanently.

MEASURING DEPTH. Timing echo of transmitted sound locates the ocean bottom, submarines. Even schools of fish can be spotted.



SONIC "X RAY" was made at Polytechnic Institute of Brooklyn by beaming sound waves through hand and displaying received signal on scope. Technique also spots flaws in metal.

WHEELS VIBRATING WITH SILENT SOUND weld strips of metal as they pass through, beating their molecules together. This is newest Westinghouse machine; others are on the market.

dirty ones that present washers can't.

- You don't have to rinse the dishes off before the washer has at them.

The dishwasher is the first home use for sonic energy, but the sound waves have been making a big noise in industry ever since World War II. Besides spotting submarines (sonar set off the boom in sonics), they perform such weirdly different jobs as:

- Finding fish for fishermen.
- Drilling holes of any shape—square, even corkscrew—in hard, brittle materials such as glass and tungsten.
- Soldering and welding aluminum and other "difficult" metals.
- Cleaning small metal parts.
- Warning of burglars.
- "Seeing" flaws deep inside metal castings.
- Treating diseases that range from osteoarthritis to tennis elbow.

The sound that does the dishes and welds the aluminum is the same as the sound of Dinah Shore—almost. The differences are differences of degree.

Most important, this sound is more powerful (than Ethel Merman even). It takes 400 or more watts of sound energy to clean dishes, several times that to weld. At her loudest, Ethel Merman belts out around 3/100 watts.

Usually, working sound is higher in pitch (than Lily Pons even). The machines used in medicine run close to 1,000,000 cycles, far too shrill for the human ear to detect (15,000 is about tops for hearing). The Narda dishwasher works at 40,000 cycles, which only bats can hear. Westinghouse and Acoustica use 20,000 cycles, a little too high for people but just right to drive the dog out of the kitchen. (All these machines make some noise you *can* hear—harmonics caused by sound waves reflected off the tank walls. It sounds like a lathe bit cutting into steel, but is not very loud.)

How the dishwasher works. The powerful, very rapid vibration of sound tears water apart, literally. Millions of invisibly small bubbles are created and collapsed, a process called "cavitation." Cavitation generates tremendous pressure and heat: 75,000 pounds per square inch (5,000 times atmospheric pressure), and 20,000 degrees F. (much hotter than the surface of the sun). In effect, the water is exploding inside. The explosions blast dirt off china, glass and silverware.

That's why the sonic dishwasher cleans so fast and so thoroughly. It gets into the tiniest cracks and crevices. (Hospitals now use similar machines for instruments so intricate they cannot be cleaned any other way; they used to be junked after they were used once.)

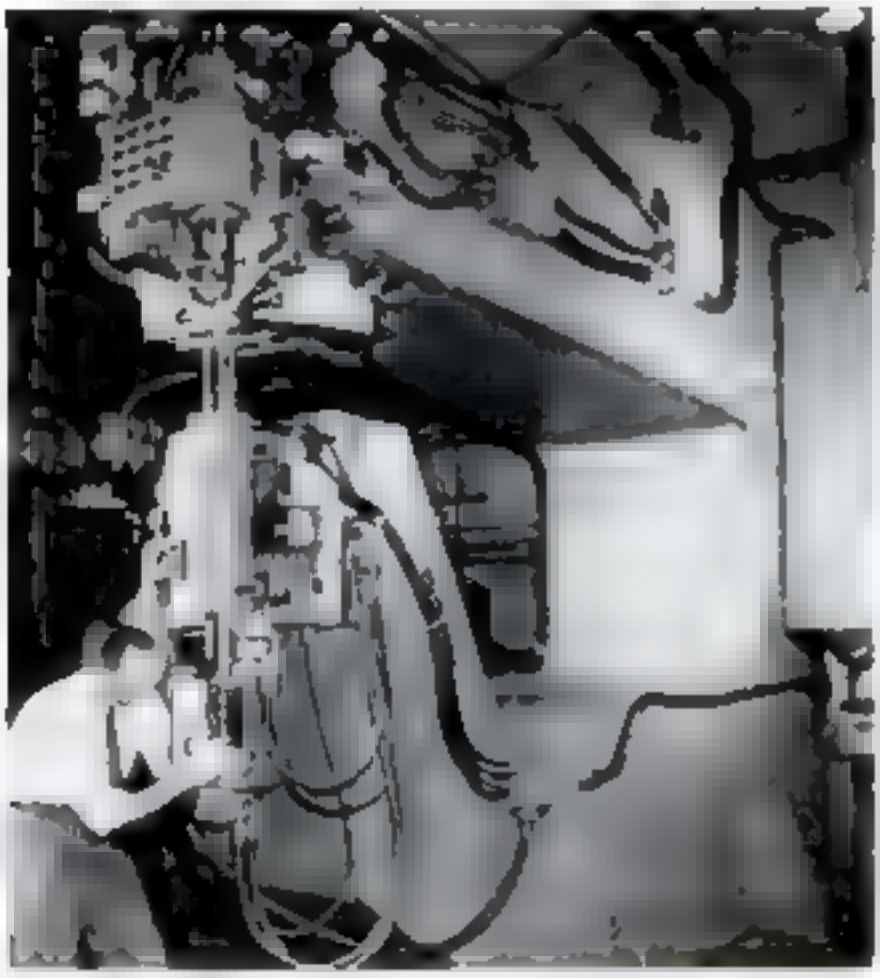
How do you make this kind of sound? Underneath the tank is an electronic oscillator that converts 60-cycle house current into 20,000- or 40,000-cycle electrical energy. Fundamentally, it's not much different from a hi-fi amplifier—but it's bigger, a lot bigger. It puts out as much as 1,000 watts, 50 times more than even an expensive hi-fi rig.

This is electricity. You want sound, the mechanical movement of water. There are two ways to get it:

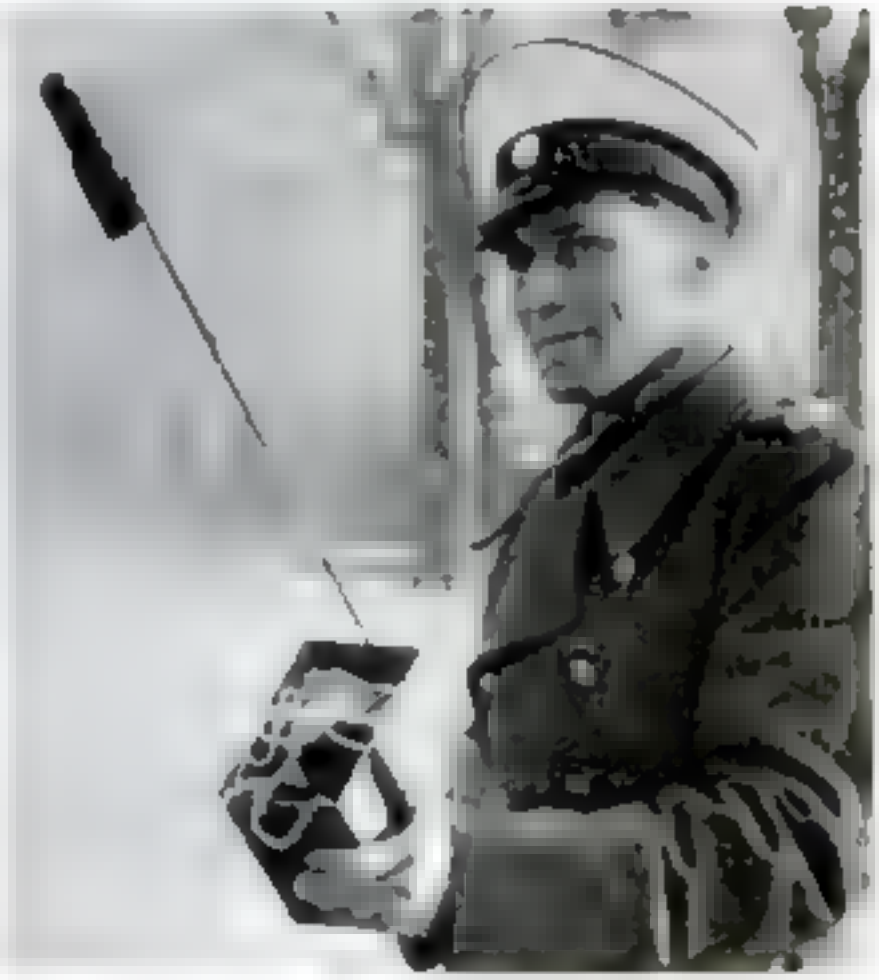
- Synthetic crystals (used by Narda

[Continued on page 268]

RETRIEVER. A paratrooper who gets entangled in chute lines as he leaps out of a C-130 (right) or C-123 can be reeled back aboard by a new Lockheed device. The reel is attached to the static lines that automatically open the chute. In case of trouble, the jumpmaster throws a switch to winch the man in.

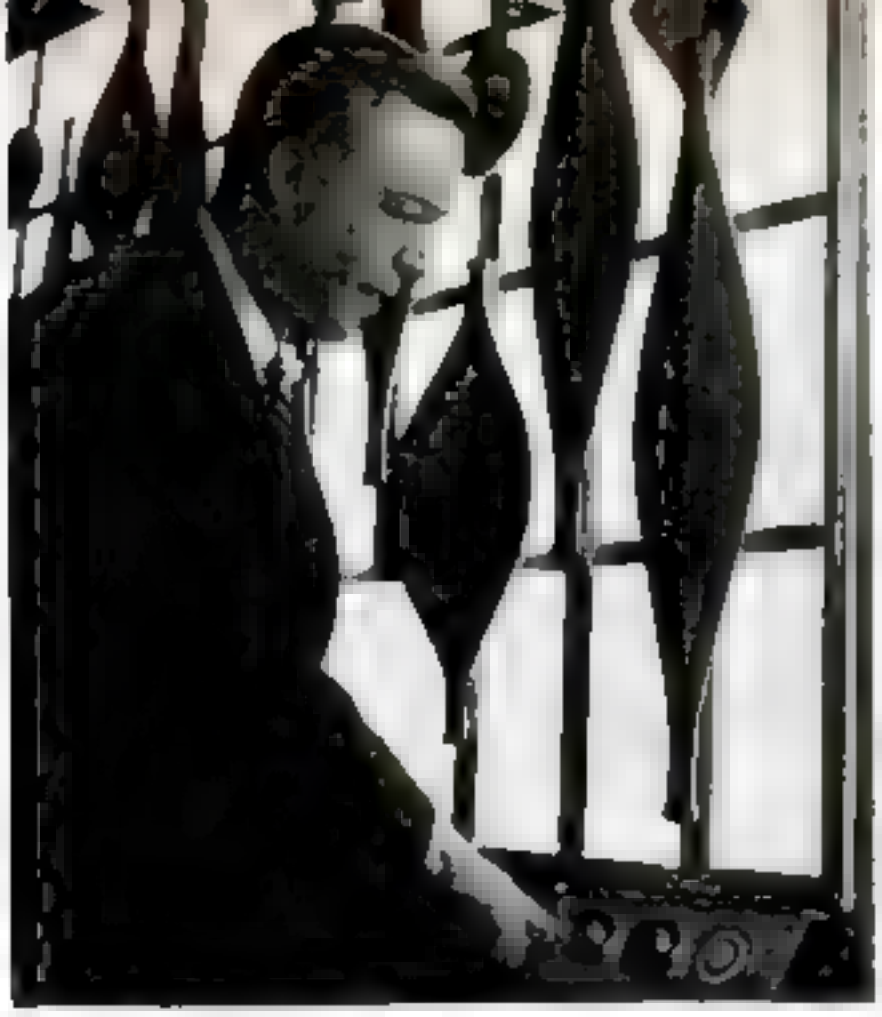


GIANT ROBOT. This 21-ton riveter automatically fastens skin and ribs of Convair 880 jetliners. It drills, inserts and finishes a rivet every 3½ seconds.



RESCUE ROCKET. The projectile held by a West Berlin policeman above helps save skaters who break through ice. Fired from shore, it carries a nylon line.

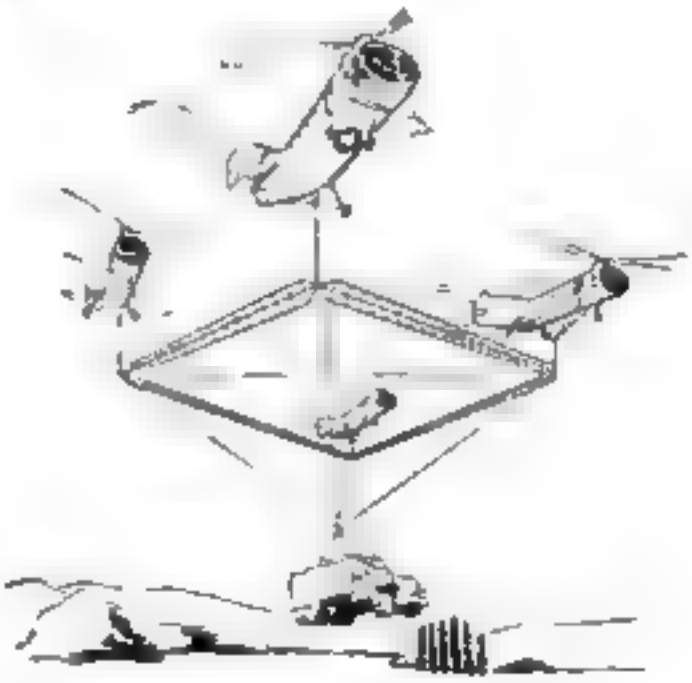
EXTRA EYES. A closed-circuit television camera (inset) back of the left rear end of each new Pontiac helps position bodies rolling off a conveyor correctly on the chassis. It gives an assembly-line operator a view of both ends at once, cuts down manpower, speeds work.



HOT-COLD LIGHT. This luminescent panel may not only light a room but heat and cool it, too. The aluminum cutouts are part of a dial controlled thermoelectric heating and cooling system under study by Westinghouse.

UNDER AND OVER. Here's a fork lift that lowers a three-ton load seven feet below the floor or raises it 12 feet above. This Towmotor model has a transparent heat shield, is used by a steel mill to dunk castings in a quench tank.

THREE-D PHOTO. This study in perspective of the statue-lined bridge leading to the Castel Sant-'Angelo in Rome was taken with an ordinary camera. The negative was used to make a black-and-white transparency, or contact diapositive. Negative and transparency were sandwiched together, emulsion to emulsion, and slightly askew so the images did not match.



WHIRLYBIRD HARNESS. The aluminum-alloy frame slung under helicopters above was built by Vertol for combat hauls. Teamed as in the drawing, four or more could lift a big Army truck too heavy for one.

A wealth of practical ideas about—

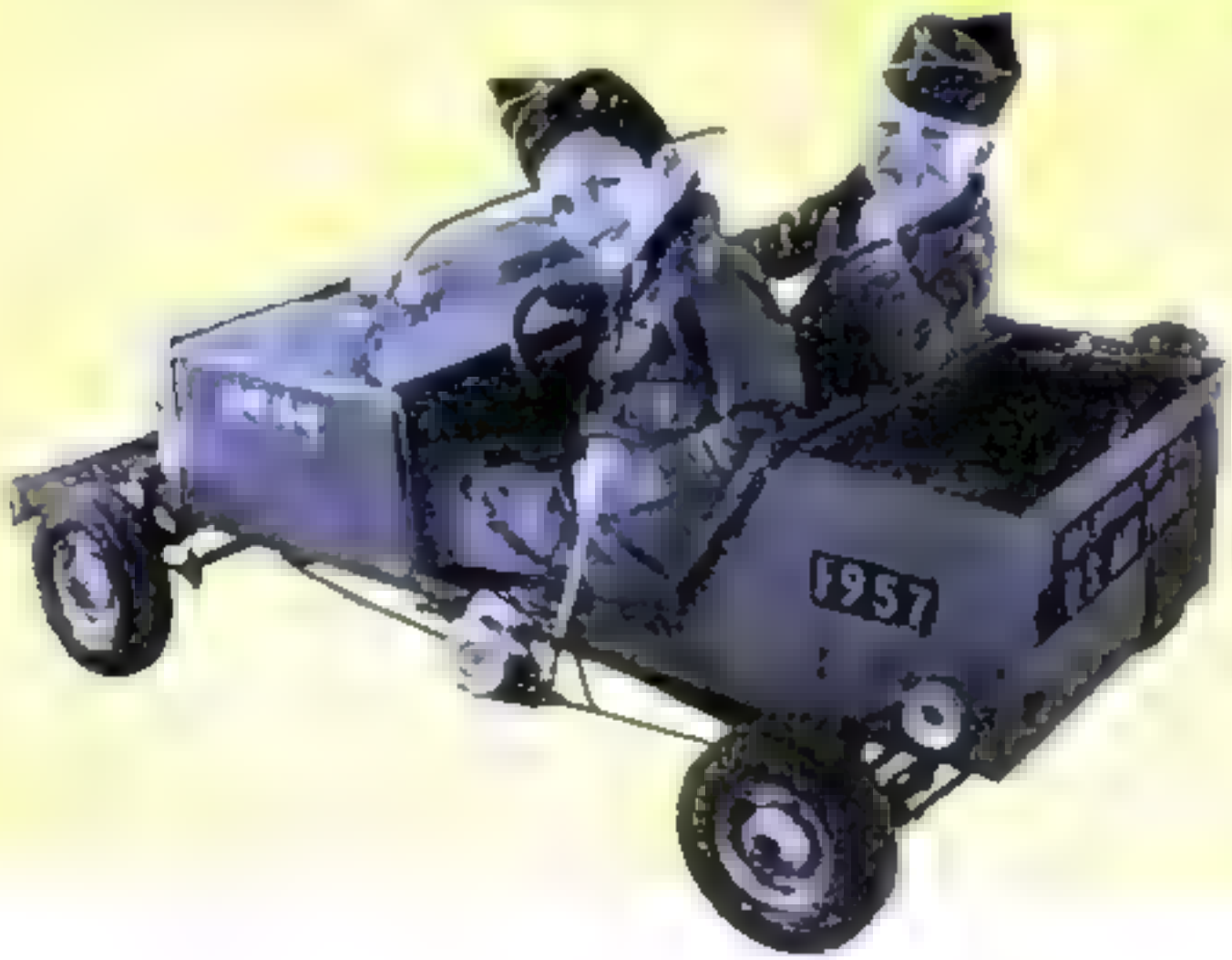
Building One-Lung Cars for Kids

By Harry Walton

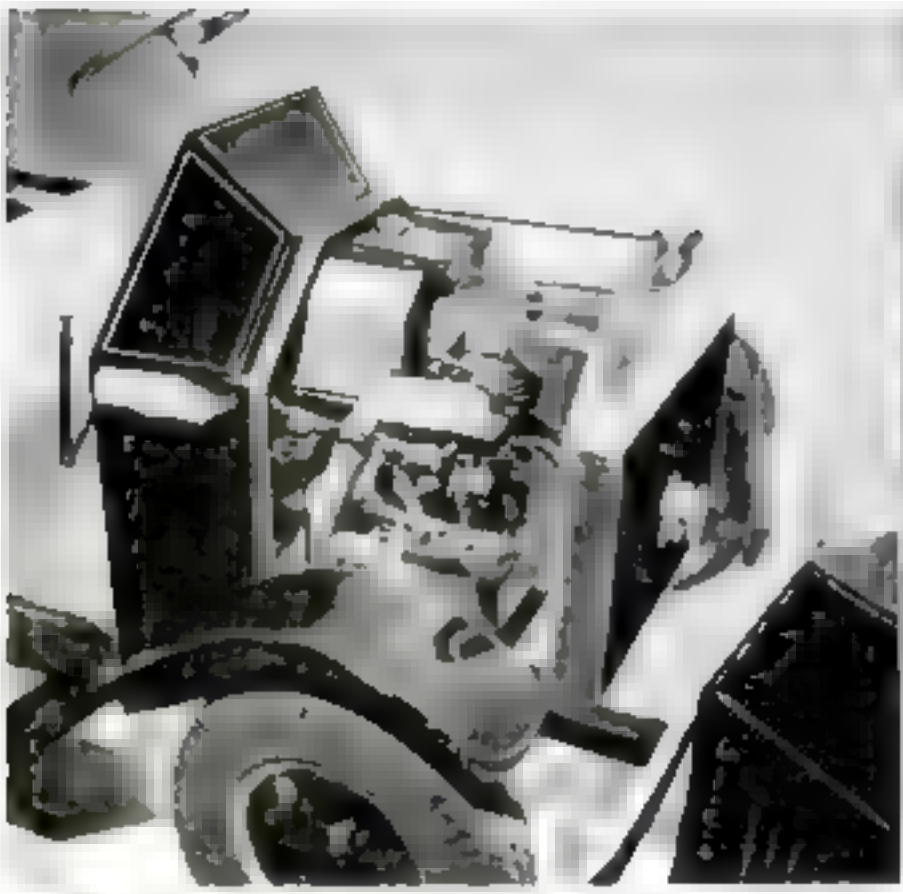
TOPS in thrills for any youngster is a car he can drive to the purposeful bark and hot breath of a real engine. Building such a car is fun for all hands from the moment you start putting a one-lunger on wheels.

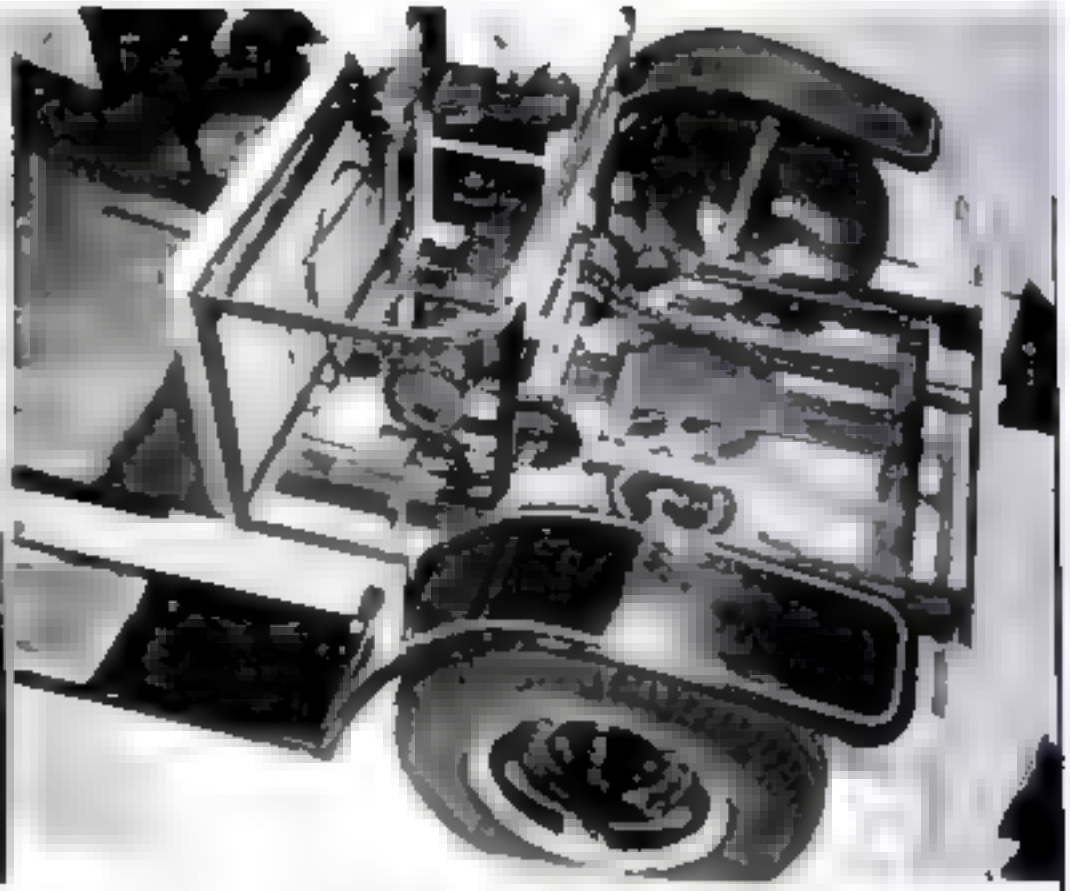
It can be simple. Boys build them with a plank for a chassis, a wooden axle pivoted on a spike for steering, and a clutchless push-and-hop-on drive. It can be sophisticated to the point of having

IT'S A FLIVVER, with a brass-bound radiator, a klaxon horn, a hand-rubbed lacquer finish and tin-lizzy fenders. Built by Robert Paul Moore of Tulsa, it has run 500 miles.



FOR YOUNG PILOTS, this Air Force jeep built by Capt. James Sparks Jr. can haul a trailer, too. A spring-loaded reel (under the lever) pulls idler to maintain driving-belt tension.





UNDER THE HOOD of the sleek flivver on the preceding page is a four-hp. engine. Through chains and a drive shaft, power goes to two identical right-angle gearboxes. So mounted that their output shafts turn in opposite directions, these drive two clutches on the countershaft. Engaging one clutch sends car forward, engaging the other clutch reverses it.

a real gearshift (from a motorcycle or small car) and spring suspension.

In between there are many ways you can build a car that will deliver a lot of fun. Although it won't be legal for street use, there is usually a yard or driveway, a dead-end turnaround or a closed road youngsters can drive on.

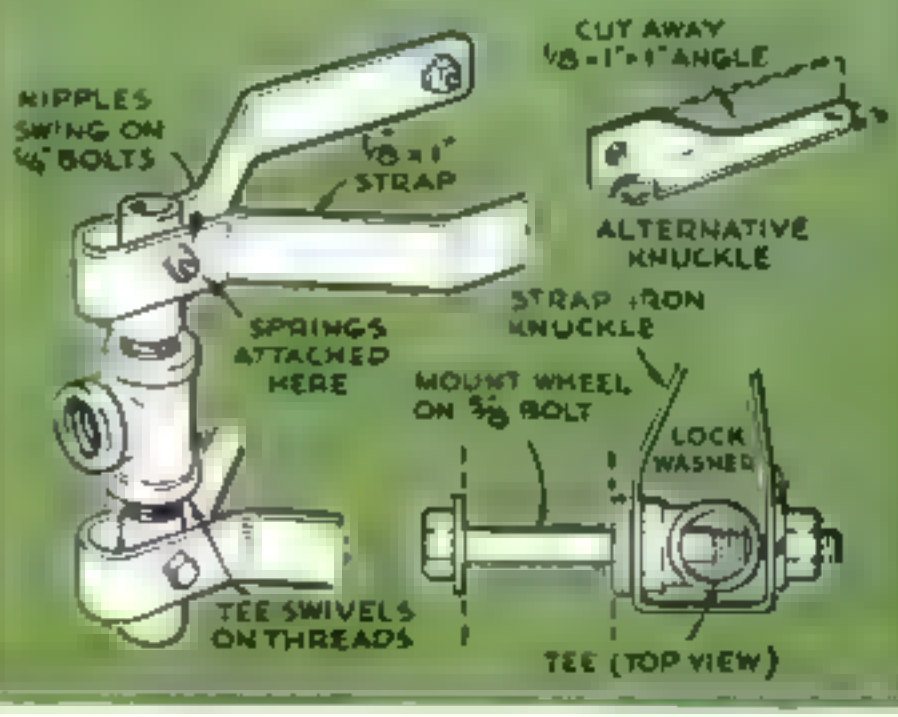
The parts you'll need. Old power mowers are a prime engine source. Look for trade-ins at mower shops. Rubber-tired semi-pneumatic wheels with built-in ball or roller bearings are sold by mail-order houses, surplus dealers, and bicycle stores. The 1.75"-by-8" size will do. Better 2.75"-by-10" wheels cost about $5 apiece.

Automatic clutches, pillow blocks, shafting, drive chains and sprockets are available from the same sources. Second-hand parts will serve. Don't overlook auto wreckers for control cables, brake, steering and body components.

There are kits, too, ranging from running-gear parts only, to those that include the drive mechanism and even the engine. You can spend as little as $20 or as much as $300.

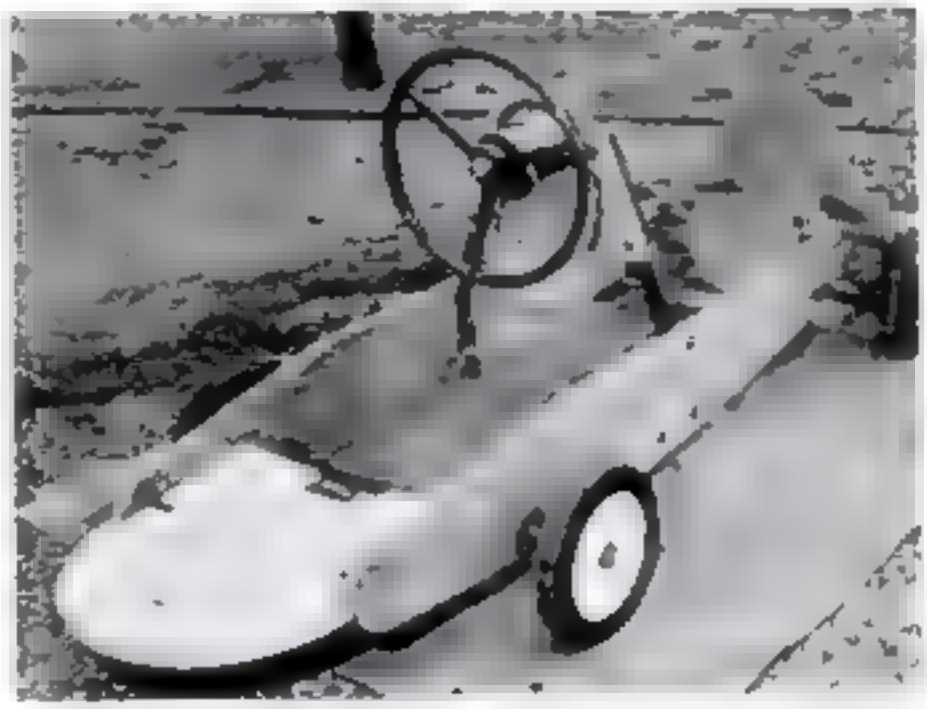
What size engine? A speed of 10 m.p.h. (ample for children) can be attained with a ¾-hp. engine. A 2½-hp. engine will wheel a car at over 25 m.p.h. One with a horizontal shaft is easier to install than the vertical-shaft kind. (These re-

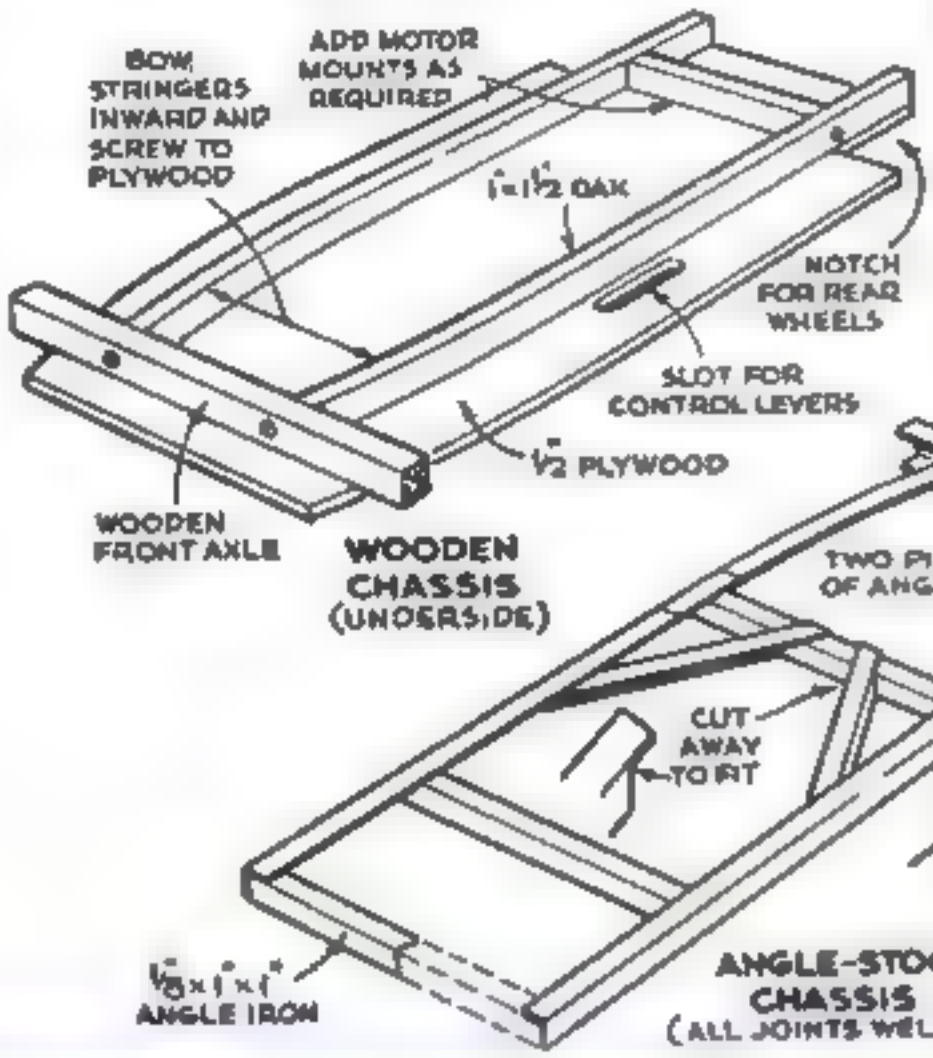
FOLLOWING AUTO PRACTICE, this ingenious wishbone arm and spring suspension devised by Sheldon Gallager of Chappaqua, N. Y., keeps wheels vertical. Pipe nipples pivot on crosspins, aligned by tee serving as the kingpin unit. No welding is required. Axle bolt goes through tee

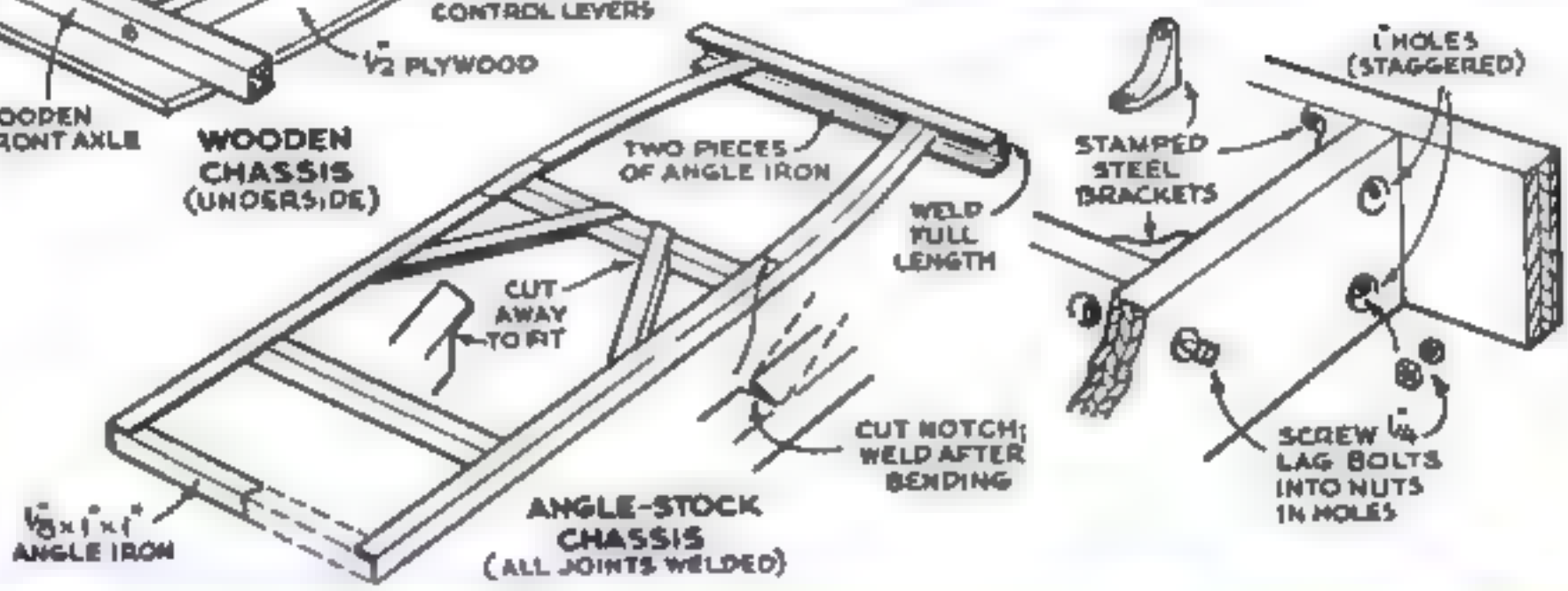


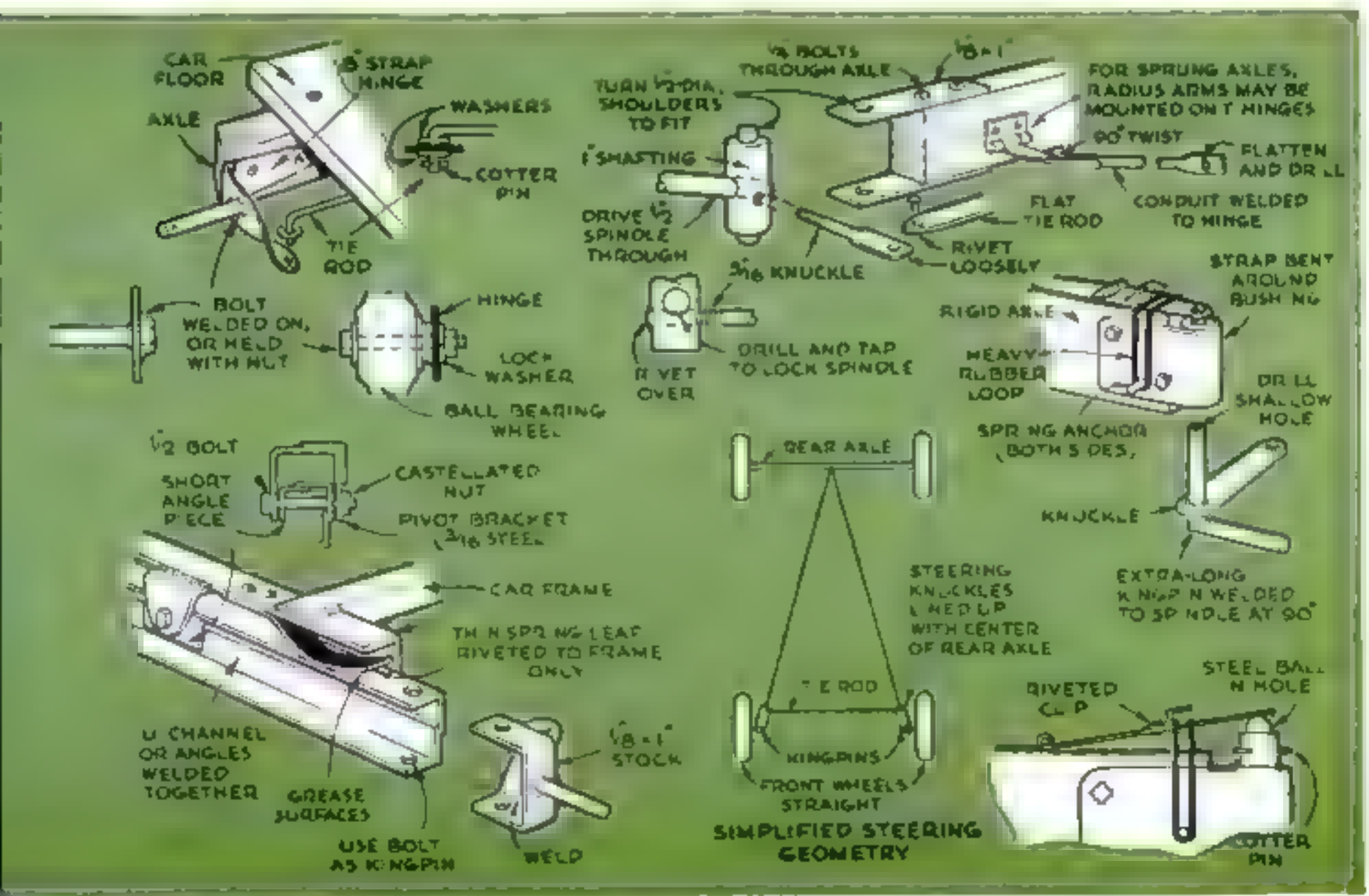
Ideas for a sturdy frame and front axles with real auto steering

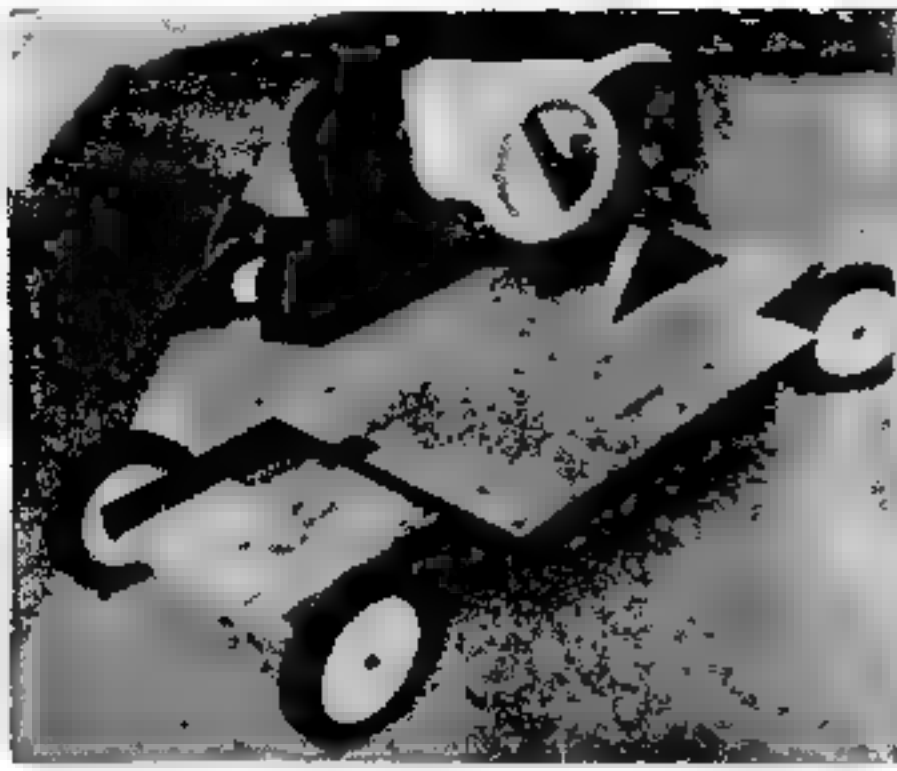
HERE ARE SOME WAYS you might build the backbone of a car. The one at right, designed for a front-mounted engine, is made of ¾" plywood. Wooden members can be joined with drawbolts as in the drawing. With welding equipment, you can use angle iron or electrical conduit.

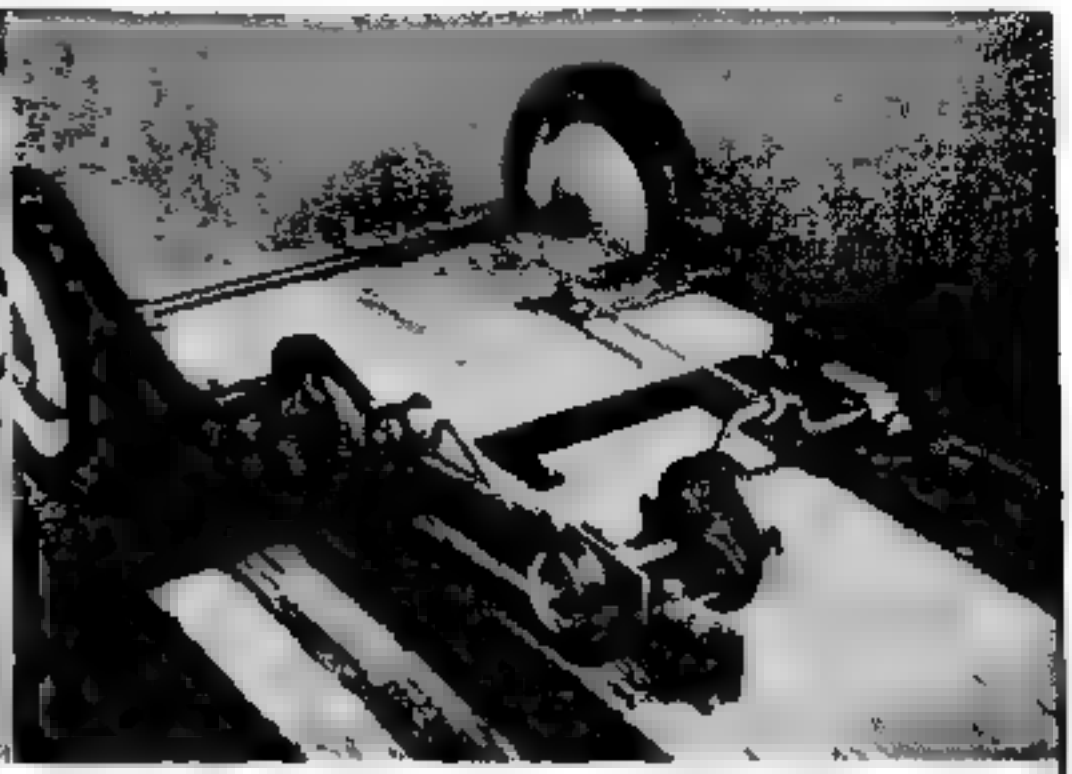




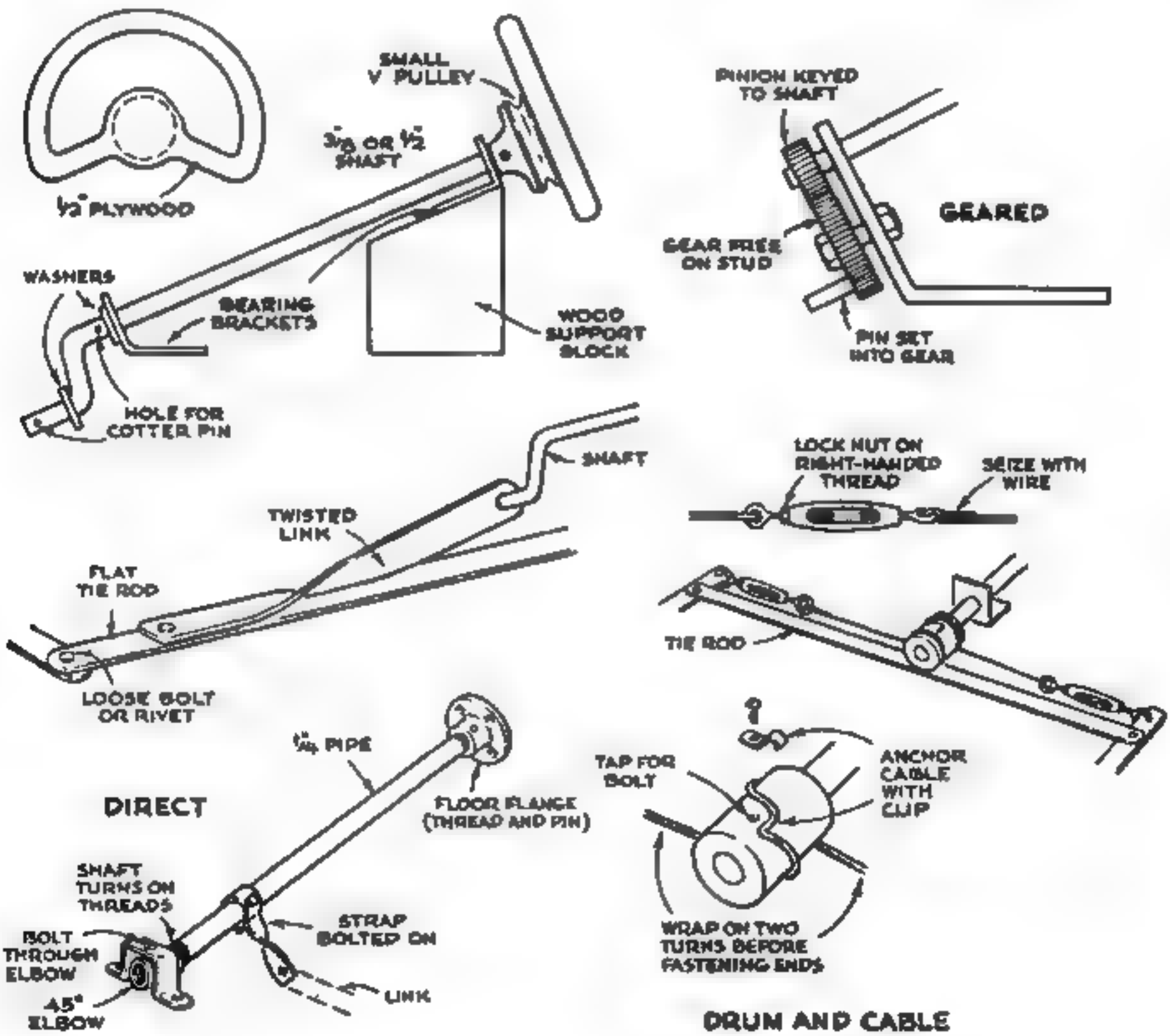








DOUBLE DECK OF PLYWOOD on two steel channels forms the chassis of this kit-built car. Steering is direct from a crank on the shaft. The drive, upside down above, takes horizontal- or vertical-shaft engines. Two countershafts and chain drive to the wheel have an overall ratio of 13:1. The control lever tightens a flat idler against a belt or, pulled back, clamps a brake onto one wheel. Kacy Mfg. Co., Genoa, Ill., offers chassis parts shown for $60, or with plywood body kit at $85. It runs well on cast-off one- to three-hp. mower engines.



quire a long belt with a 90-degree twist.)

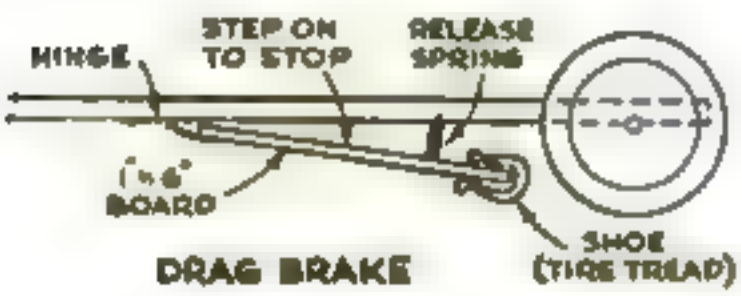
Checking the throttle action. If an engine has an air-vane governor, you may want to connect the control cable directly to the throttle for quicker response. Rig a return spring on the throttle arm so that if the control fails, the engine will snap back to idling.

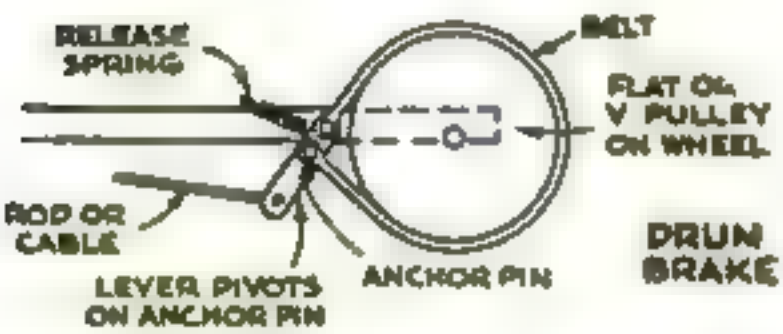
Sizing up the chassis. The wheelbase may be from 40" to 60", the tread from 22" to 30". A short wheelbase turns more sharply; a longer one makes the drive easier to arrange, and affords more legroom for growing youngsters.

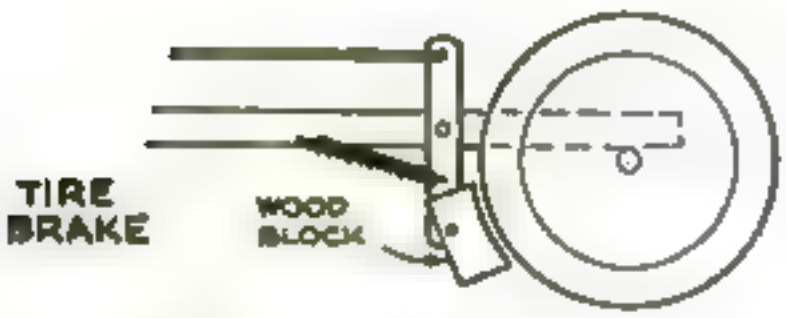
Put the engine in back to simplify the drive and to add its weight for good traction. But don't mount it so far back that it tends to tilt up the front.

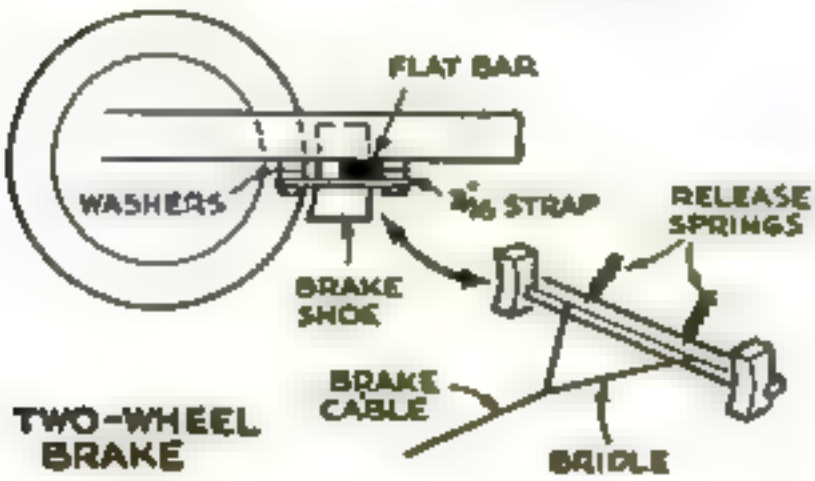
The frame need not be rigid; some flexing compensates for the lack of springs, helping to keep all four wheels

STRICTLY HOMEMADE, this car is the work of young Mike Zingarelli of White Plains, N. Y. It is built on a ¾"-plywood platform, with a 41" wheelbase. A 2" centrifugal clutch on the two-hp. engine drives a 6" wheel pulley. This low ratio is speedy but wears the belt on starts. Mike helps out by pushing, then hops on. He made a good-looking steering wheel of a baby-carriage wheel by removing some spokes.









BUILT OF STEEL TUBING, this car comes ready-made with 1.75"-by-8" wheels at $40, or with 2.75"-by-10" wheels at $50. It has automotive steering and a brake acting on both rear wheels. Rocco Products, Inc., Minneapolis, Minn., offers drive kits for it less motor for $20 and $30, with motor at $70 and $90. Rack-and-pinion steering can be added to the assembly for $10, and snow runners for an additional $8.

on the ground. Wood makes a satisfactory frame requiring only common tools.

Auto-type steering can be improvised from hinges, scrap iron or even pipe fittings, as shown. Angle the steering knuckles inward. This maintains correct radius in turns. Hold wheels on with husky cotter pins or by clamping the inner bearing race tight with a nut on a threaded spindle bolt.

The simplest steering with a step-down ratio is the drum-and-cable type. The drum must be concentric with the shaft and pinned to it. Use the $\frac{3}{32}$" steel cable and end clips sold for power-boat tillers.

Brakes are a must. For modest speeds and level ground, a single one on the nondriving wheel suffices. Line wooden brake shoes with machine belting or tire tread. See that brakes release fully.

How to rig a drive. With an engine of two hp. or more, a single reduction of one to six or seven will roll the car too fast for children. An overall ratio of 10, 11 or even 13 is safer

Drive one wheel only. You can key it to the axle, mounted in pillow blocks, and drive the axle, but it is simpler to fasten a "dead" axle solidly, let both wheels turn on it on their own bearings, and bolt the drive pulley on one.

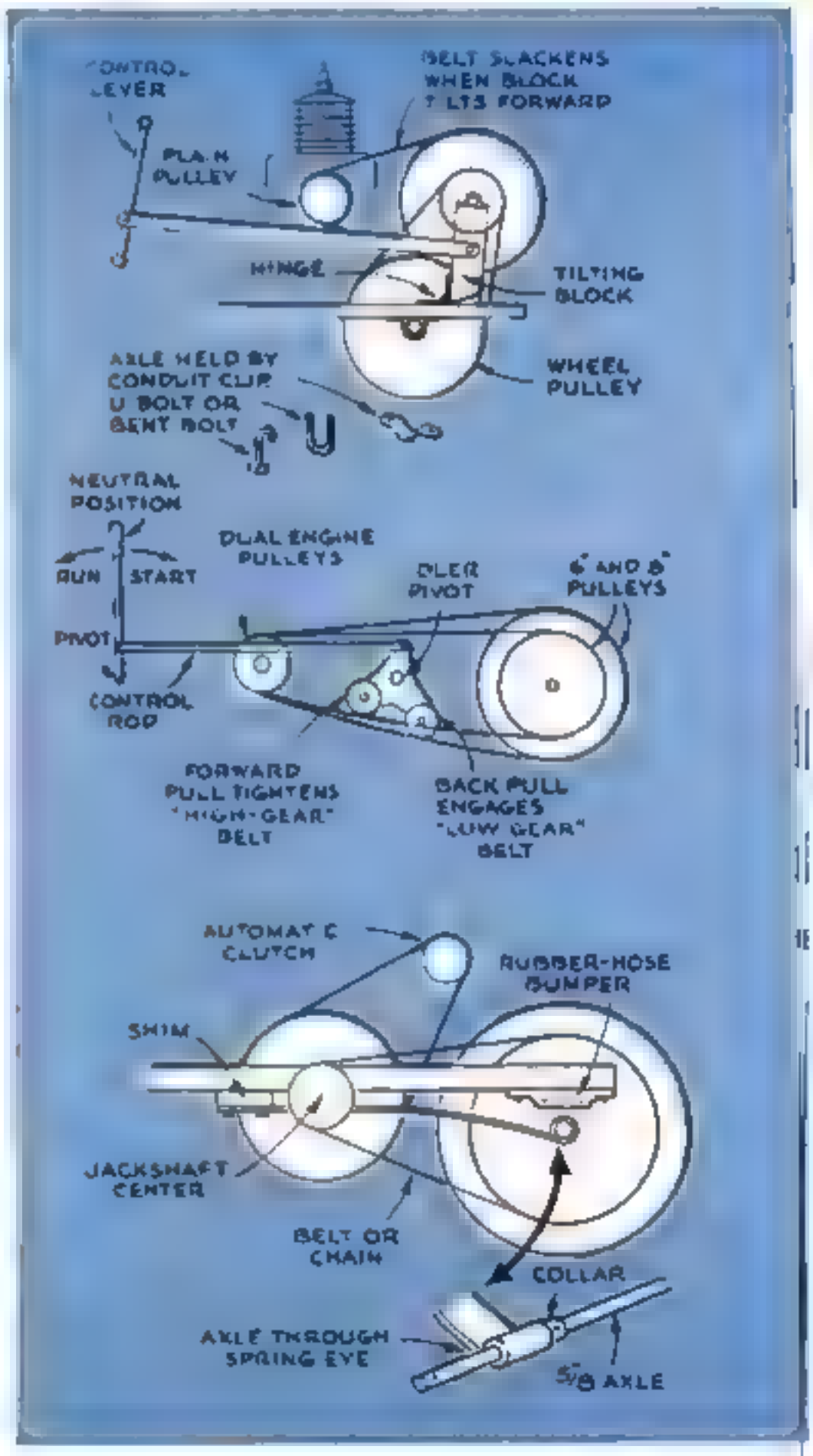
To center a pulley or sprocket having a hole bigger than the axle, drill bolt holes oversize and mount the pulley with the nuts finger-tight. Spin the wheel on the axle to detect run-out. Tap the pulley or sprocket one way or the other until it runs dead true. Then tighten the nuts.

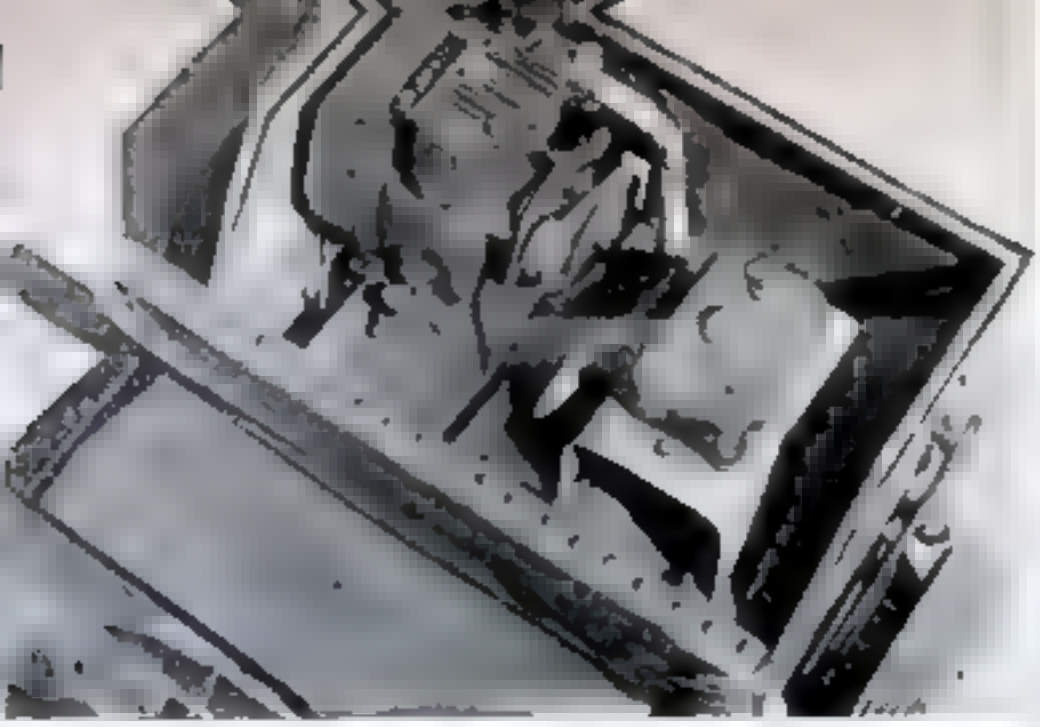
Be sure to mount the engine to drive forward. Pipe the exhaust downward and shield hot parts. Hang countershafts in pillow blocks or oilite bushings. With sprung rear axles, the countershaft must be so mounted as to maintain a constant distance between the drive pulleys.

A stepless ratio shift can be had with a transmission pulley. Not to be confused with an automatic clutch, this forces the belt to ride on a greater diameter as speed goes up. A spring-loaded idler or swinging countershaft is necessary to keep the belt taut.

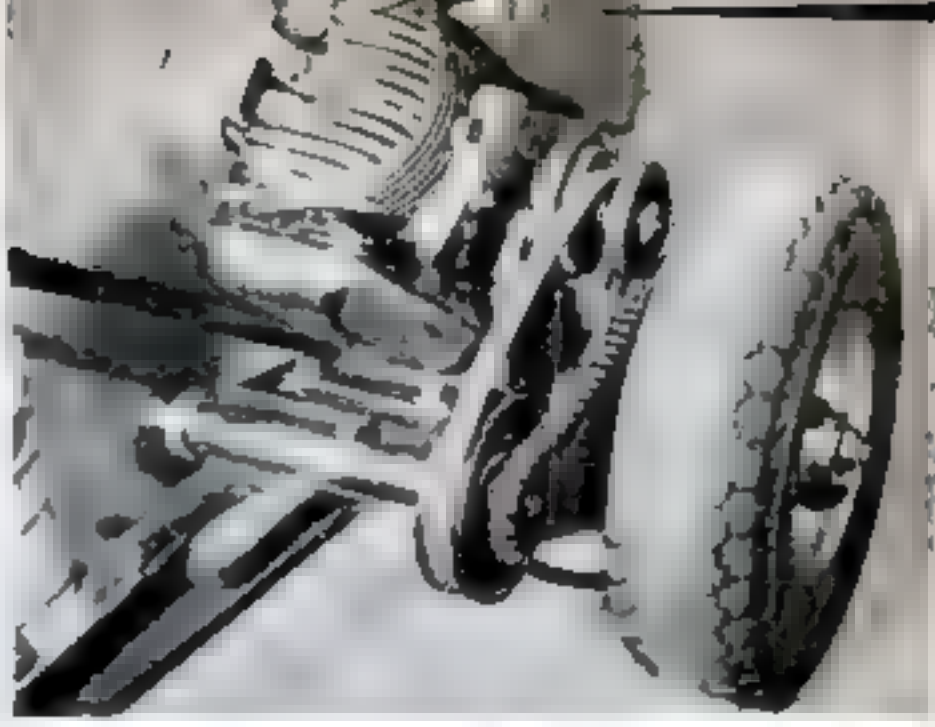
Cut paper patterns as guides in shaping sheet aluminum or galvanized iron over the body. Old auto fenders can be cut down for parts requiring difficult compound curves. Metal plasterer's lath makes a neat radiator grille.

A DRILL-PRESS SPEED CHANGER (top left) or the similar device near it makes a compact variable-ratio drive. These shift one belt to a smaller, the other to a larger diameter as the lever is moved. Automatic clutches shown are (left) mercury and (right) centrifugal types.

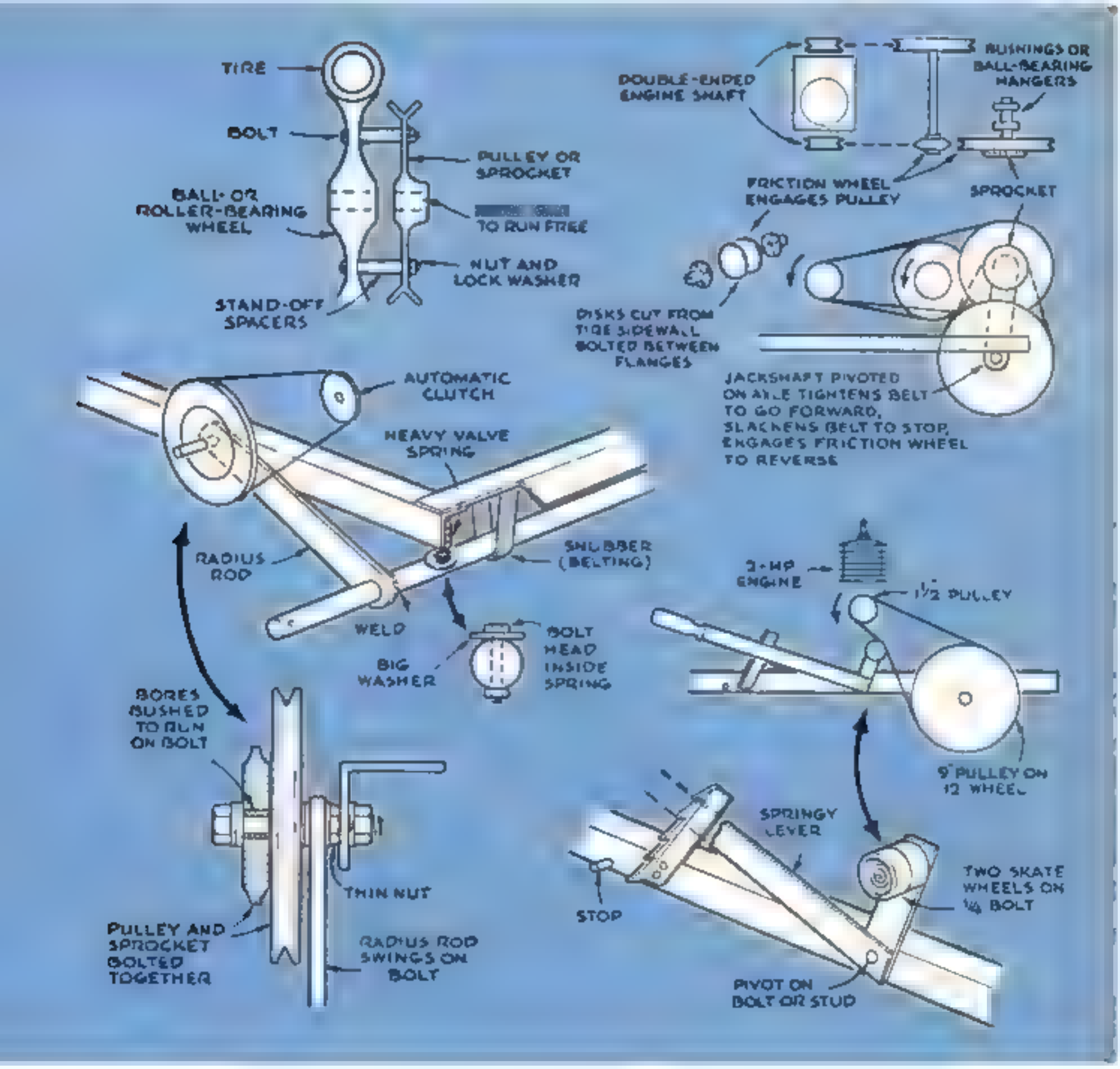




BOXED-IN ENGINE of Capt. Sparks' jeep drives a jackshaft extending over the drive wheel. The rear axle is mounted on half lengths of auto leaf springs. Spring-tensioned idler keeps the belt taut. Pushed forward, the control tightens a band brake on the other (nondriven) wheel.

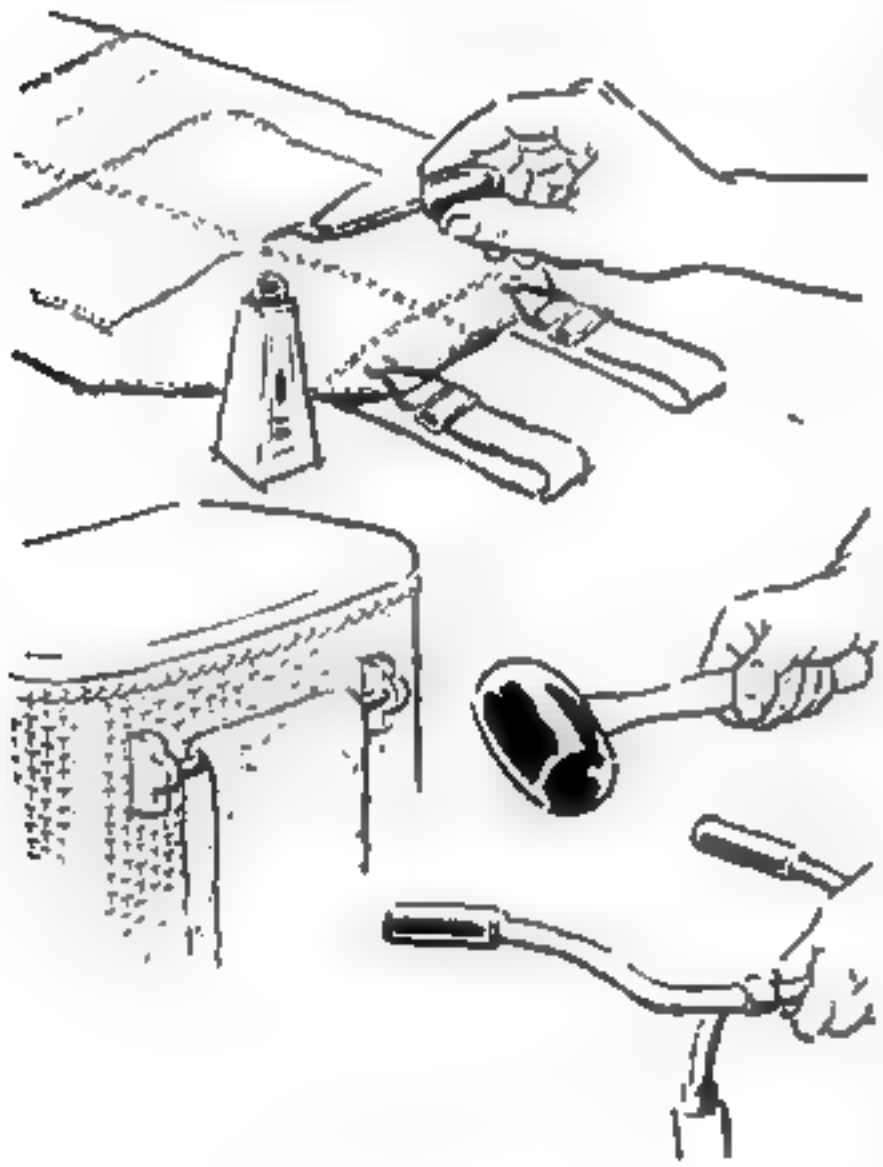


SLICKLY PROFESSIONAL is this two-step reduction drive engineered by V-Plex Clutch, of Hagerstown, Ind. The jackshaft turns in a tubular crosspiece mounted on one frame member. As the engine revs up to 1,800 r.p.m., the centrifugal clutch engages the belt. END



5 Budget Savers

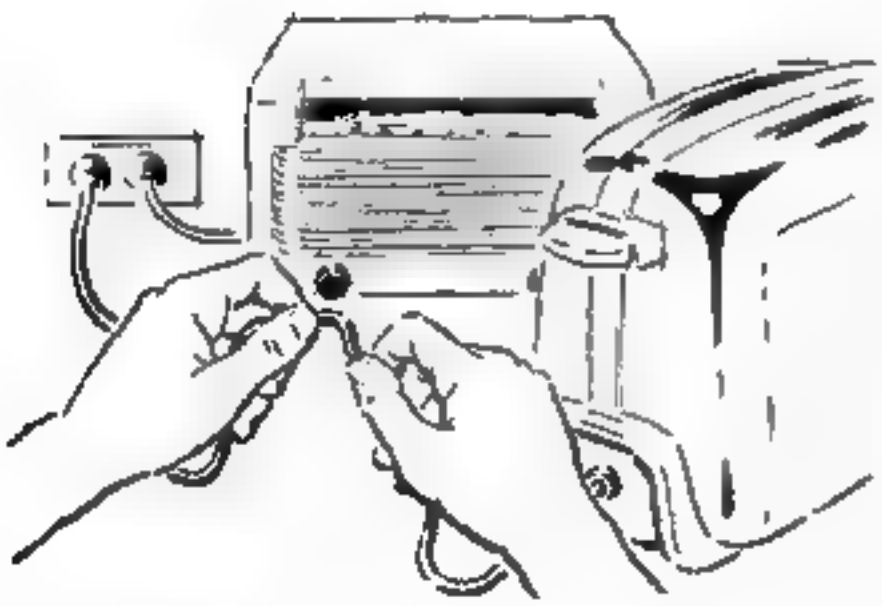
1 Got a cat in your house? Save yourself work by hoarding empty milk and orange-juice cartons. Cut them off at the bottom to a height of about two inches to make disposable food and water dishes. They will eliminate dishwashing for a small dog or a puppy, too.



2 The edges of pockets on overalls and other work clothes can be saved wear and tear if they're coated with colorless fingernail polish. Dab on enough polish to provide a hard, smooth edge.

3 A bathroom hamper can provide space for an extra towel rack that will be within reach of a youngster. Make wooden brackets to take a length of dowel rod and screw them to the hamper through the wicker and into the internal frame. For even more towel space, racks can be put on the hamper sides, too.

4 Need handle grips for a trike? Cut two 4" lengths of ½" plastic hose and soak them in boiling water about five minutes to soften the plastic. Lift them from the water and drive them onto the handlebars with a rubber mallet (or piece of wood). After cooling, they'll be so tight you can't budge them.



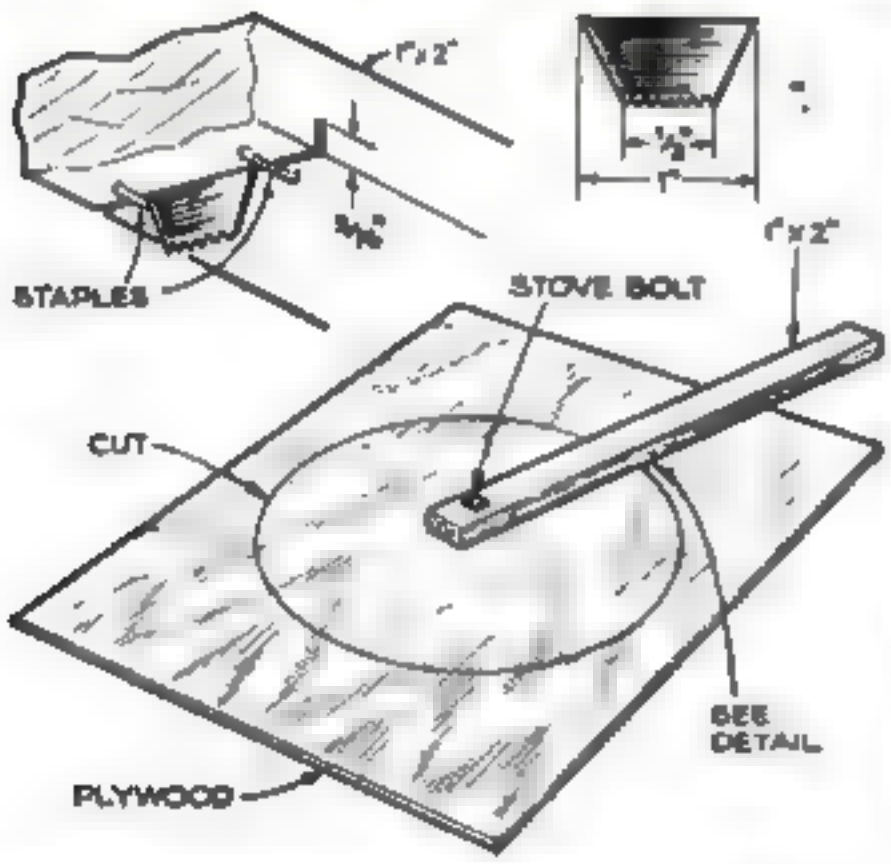
5 If an appliance cord conks out because of a defective wire, use a radio to spot the break. Turn on the radio and adjust the dial so that no station is heard with the volume control on full. Now switch on the appliance and twist the cord along its length, about an inch at a time. When you hear crackling noises from the radio, you've found the break.

Short Cuts and Tips
FROM PS READERS

How to Saw Accurate Miters

CUTTING miters accurately will be simplified if you first saw all parts to the exact length needed and then miter the ends.

To be sure that you cut the same amount of material from each of these parts, clamp a scrap block to the saw table as a stop before cutting.—*R. J. De Cristoforo, Los Altos Hills, Cal.*



Cutting Circles in Plywood

IF YOU don't own a jigsaw and need to cut a large circle in plywood, you can make a true circle of any desired diameter with a piece of hacksaw blade and a 1"-by-2" strip of wood. Cut the strip to the length of the radius plus enough more for a handle. Then drill one end to take a stove bolt pushed through the work at the center of the circle to be cut.

The cutter is a 1" length of hacksaw blade ground to ½" at the teeth. Set it in a kerf the distance of the radius from the bolt hole and fasten with two staples. —*T. B. Edwards, Alexandria, Va.*

Keeping Small Parts Secure

THOSE plastic boxes used as containers for screws, nuts and other small hardware are fine, but when you carry them in a tool box the lid is apt to come off and let the parts scatter all over.

A couple of ordinary rubber bands over the box will hold the lid tightly in place. —*John A. Comstock, Wellsboro, Pa.*

▶▶▶REMEMBER that the rubber tread from a child's bicycle pedal can be slipped on a file tang as a temporary handle.—*Federico Strasser, Santiago, Chile.*

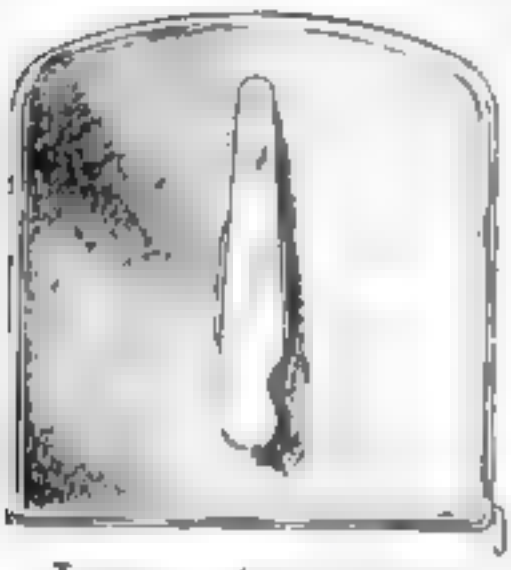
Short Cuts and Tips
FROM PS READERS

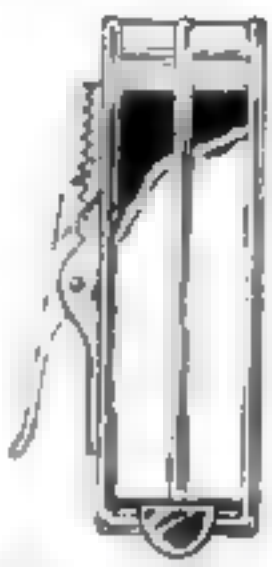
How to Touch Up Table-Saw Blades

SHARPENING a dull blade is a real job. To avoid it, keep your blades sharp with frequent touch-ups without removing the saw from the arbor.

Clamp a board between blade and rip fence; then dress and de-gum the teeth with a sharp triangular file. Be sure to maintain the original tooth angles and bevels of the saw.—*Joseph T. Burch, Seattle, Wash.*

Clip for a Tape Measure



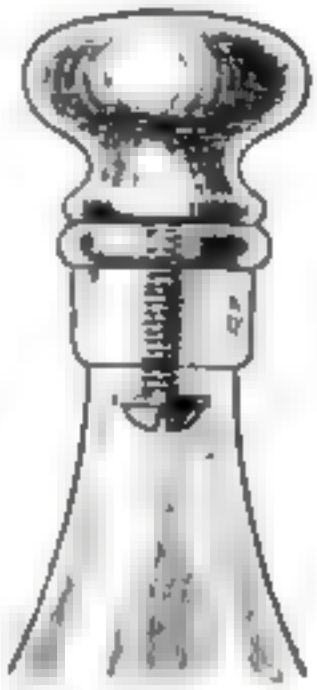


I USE a tape measure constantly, so I soldered an alligator clip to one side of the case. Now it's handy on my belt or a clipboard.—*W. W. Graf, Long Beach, Cal.*

Dripless Drawer-Knob Spraying

IT is difficult to prevent paint drips when spraying drawer knobs in a horizontal position.

I get good results by threading their screws into them and setting them vertically in the necks of empty bottles so the drips run down to the face that will be hidden from view — *William B. Eagan, Floyds Knobs, Ind.*



Restoppable Vent for a Metal Can

WHEN you vent a metal container that will be moved about considerably or stored for long periods between use, drill the vent for a metal screw.

This will allow you to tighten the screw after each pouring and seal the contents against leakage or contamination.—*Robert Maas, Portland, Ore.*

Which Spray Outfit Is Your Best Bet?

A gun is the fast and easy way. But it's important to suit the type to the work

By George Daniels

BETTER than 30,000,000 gallons of paint and lacquer went through America's spray guns last year—enough to coat more than 20,000,000,000 square feet of surface.

The spray gun got the job because no other painting tool is as fast and versatile at top-quality finishing. It can handle anything from heavy barn paint to liquid wax. And, even in the hands of an amateur, it works up to 10 times as fast as a paintbrush.

But the big question is: *Which* type of spray outfit is the best for you? You can pick from scores of makes, models and sizes. You can spend from $5 to more than $300. Not counting many small, self-contained guns and sprayer attachments, you'll be faced with such choices as:

- Three basic types of compressors.
- Two different types of spray guns.
- Two different types of nozzles.
- And two methods of air control.

If all this sounds confusing, it needn't be. The thing to remember is that each type has a particular job that it does best in its price class. How far up the price ladder you go depends on the *size* of the jobs you plan and the *kind* of paint you want to spray.

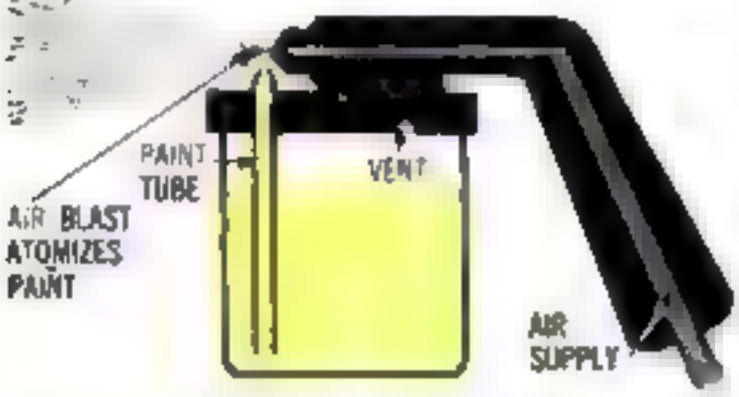
Price and size. For touch-up and general workshop jobs, you can choose units of two- to 24-ounce paint capacity priced at $5 to $50. Within their working range they'll do a professional-grade job.

But, in general, they're not fast enough for bigger jobs and aren't suited to heavy-bodied materials like thick house paint. The reason: It takes more power to spray paint fast, still more to spray thick paint. And you can't have both high power and low price.

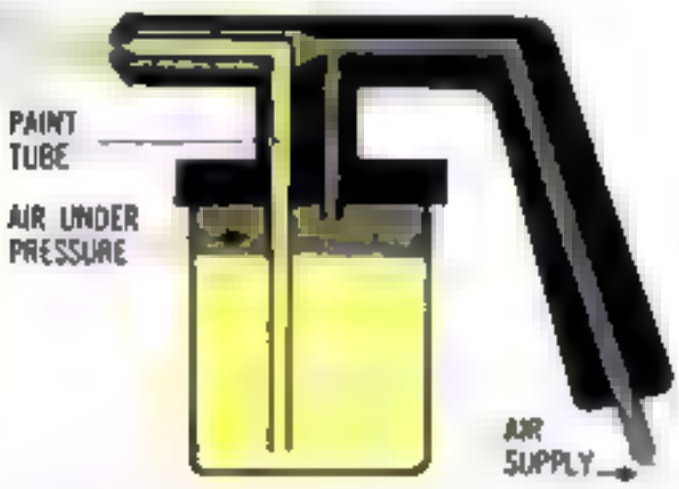
For big jobs, prices start at around $60. This gets you a motor, compressor, air hose, and gun, ready to use and capable of spraying practically any type of sprayable paint you can buy. From there on up, more money buys you greater capacity and greater convenience through special extras and accessories.

The important point: Buy an outfit equal to

Guns turn paint into spray in two different ways



AIR PULLS PAINT out through nozzle by creating partial vacuum at top of paint tube in simple suction-feed gun. Vent hole lets outside air into container.



AIR PUSHES PAINT out through nozzle in more complex pressure-feed gun. In this type, air is fed into container, forcing paint down, then up and out tube.

the work you'll do. A small unit on a big job runs too long, wears too fast, and soon washes out initial cost savings. Here's how large and small compare:

Low-cost sprayers are made in five common types: vibrator, rotor compressor, gas cartridge, and car-engine and vacuum-cleaner attachments. Each has its own advantages, and a few have features that the big outfits can't equal.

The vibrator gun is self-contained and uses a cigarette-size vibrator-type motor to pump paint from the screw-on glass container and spray it through an adjustable nozzle (for fine or coarse spray) by direct pressure. It's easy to use—just fill the container with paint, plug in the cord, and pull the trigger to spray.

It handles varnish, shellac, lacquer, insecticides and the usual household paints. But don't count on it for heavy-bodied, hard-to-spray materials, and don't plan to paint the barn with it. Prices for a 24-ounce vibrator sprayer weighing less than three pounds run from $10 to $15.

The rotor-compressor sprayer provides around 20 pounds of pressure with a small, high-speed fan-like blower. The hose from compressor to gun is kept short—about four feet—to prevent loss of pressure, but that's long enough because you carry the four-pound compressor with you in a shoulder sling as you work.

As there are few moving parts, this type of compressor is long-wearing and suited to lengthy periods of operation. Numerous accessories are available to fit it for plant dusting and insecticide spraying. You can even get a hollow-needle attachment that permits the gun to shoot moth repellent deep into seat cushions. It has the same 24-ounce paint capacity as a typical vibrator sprayer and handles about the same material. Prices range from about $30 to $50.

The gas-cartridge gun uses the same type of carbon-dioxide cartridge as the familiar fizz-water bottle. It's self-contained and easy to use anywhere from the roof to a crawl space, as it needs no electricity and no trailing hose or extension cord. A single 11-cent cartridge (available at most drug stores) will handle a full 21-ounce paint container, and will spray insecticide, too.

This type of sprayer is not recommended for fine finishing like repainting a car, but it will do less exacting jobs nicely, such as painting outdoor furniture, trim, metal and masonry. A typical all-metal gun suited to home-owner use sells for about $20 with 10 cartridges.

The car-engine gun is the fix-it type you've seen in auto-supply stores for more than 20 years. A simple one-way air valve with a threaded adaptor is screwed in place of a spark plug to use

How You Lose Pressure with a Long Air Hose

Length of hose	Pressure drop with ¼" hose	Pressure drop with 3/16" hose
5 ft.	6 lb.	2¼ lb.
10 ft.	8 lb.	2¾ lb.
15 ft.	9½ lb.	3¼ lb.
20 ft	11 lb.	3½ lb
25 ft.	12¾ lb.	4 lb
50 ft.	24 lb.	8½ lb.

your car's engine as a compressor. It uses a little syphon-type gun that works like a perfume atomizer.

A tire-valve adapter lets you spray paint, using a spare tire for air supply. Switch the fittings and you can use the spark-plug valve to pump up a flat tire.

These midget sprayers are designed mainly for touch-up work. They'll handle auto lacquer nicely and most household finishes, but aren't well suited to heavy-bodied materials. Prices start at $5 for the smallest, with a four-ounce capacity (enough for a car door).

Vacuum-cleaner attachments are perhaps the most widely used of the small-job sprayers because just about anyone with a reversible vacuum cleaner can add one for $3 to $4. You simply hook the gun to the blower side of the cleaner.

Attachments of this type make the most of the low-pressure air supply by using a pressure-feed gun that blows the paint out of the canister, instead of sucking it out as in some other types. These do a fine job with average light-bodied paints and demothing sprays that don't require high pressure. A minor drawback is the short, fat air hose (the same as used for vacuum cleaning), not handy for lugging up a ladder.

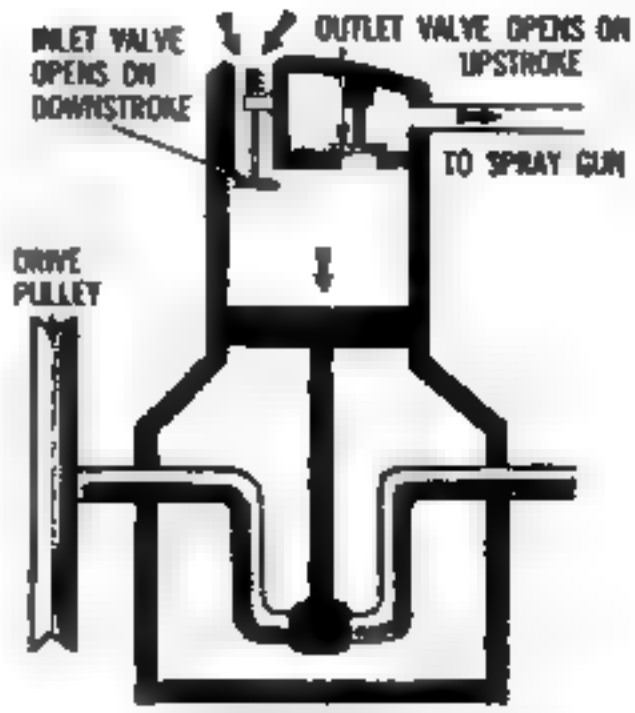
When do you need a "big" sprayer? When your job can be measured in gallons of paint rather than pints or quarts, the chances are you'll want to consider a motor compressor and a suitable gun. Power ranges from ¼ hp. upward.

If you buy a prematched unit, you need only be sure it can handle the kinds of paint you want to use. If you buy the parts separately, you add another important must: Your compressor's output must equal or exceed the requirements of the gun. Here's what you need to know:

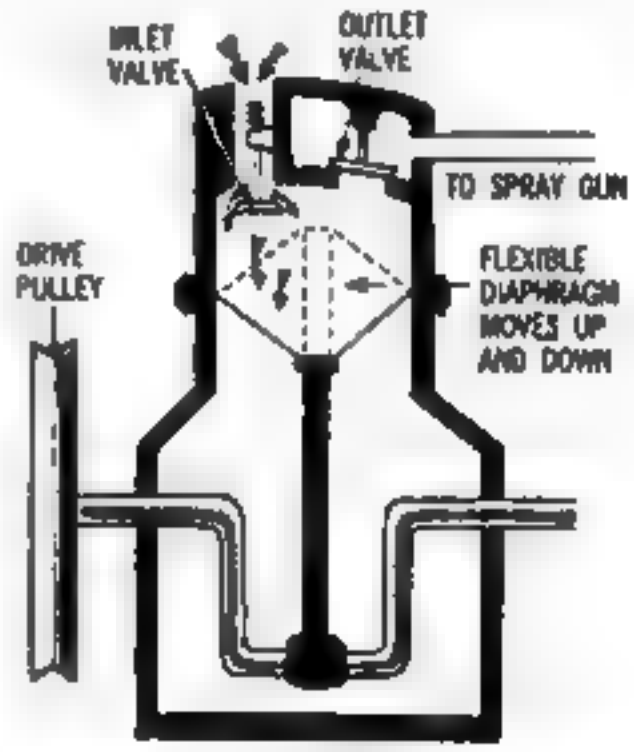
Diaphragm vs. piston compressors. Diaphragm compressors give you the necessary big-unit output at a much lower initial price than piston compressors. While they don't have the top capacity of a piston unit, they'll deliver air at up to 45 pounds' pressure—enough to spray any paint you'll want to use around the home. The main bit of maintenance required is occasional replacement of the diaphragm (like those in your car's fuel pump). This takes only a few minutes.

Piston compressors are a good buy for professional use because they stand up

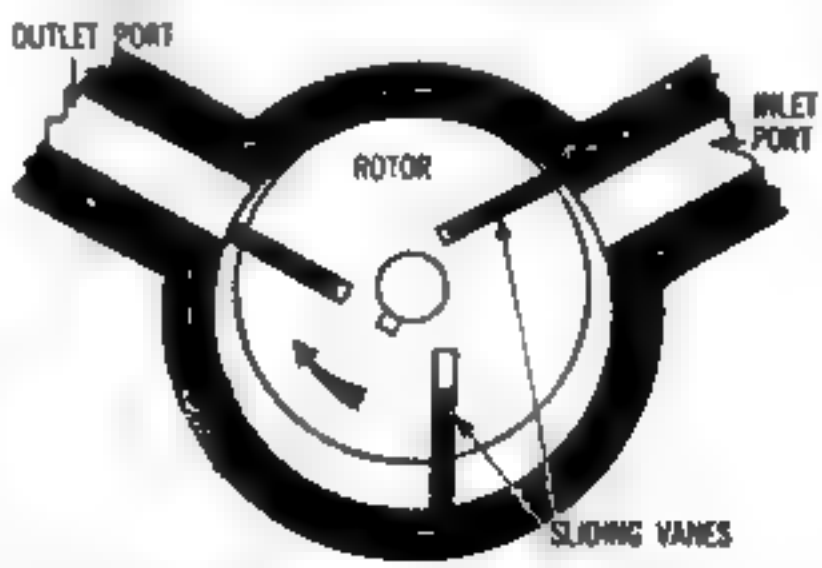
How compressors work



PISTON COMPRESSOR, most powerful and expensive, draws air in through inlet valve on downstroke, then forces it out through outlet on upstroke.

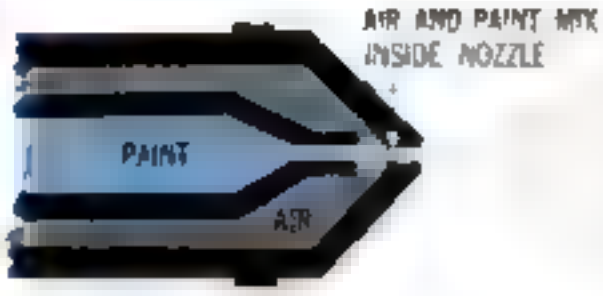


DIAPHRAGM COMPRESSOR is middle-priced, will handle most home jobs. It's similar to piston type, but needs occasional replacement of diaphragm.

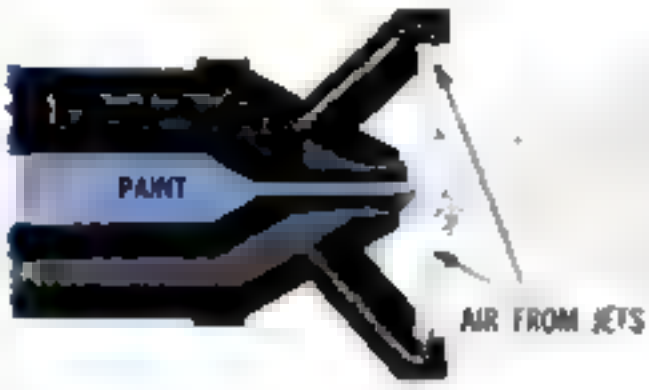


ROTOR COMPRESSOR is light, one of least costly, but is less powerful. Vanes in rotor slide outward, sweeping trapped air at high speed from inlet to outlet.

Two nozzles you can use



PAINT AND AIR MEET INSIDE NOZZLE in the internal-mix type, best for slow-drying finishes that won't clog. It can be used only with pressure-feed guns.



PAINT AND AIR MEET OUTSIDE NOZZLE in this external-mix type, best for quick-drying finishes. It can be used with either suction- or pressure-feed guns.

for years without maintenance and deliver pressures of 100 pounds or more. But they're a good deal more expensive. A typical diaphragm outfit, complete with gun and delivering 3.6 cubic feet of air per minute at 35 pounds' pressure, sells for $133.50. A piston unit of the same make, delivering 3.2 cubic feet per minute at the same pressure, costs $196.50. Either of them could spray-paint in two days an average house that would require six days by brush.

How compressors and guns are rated. Compressors are rated according to the volume of air they can *supply* at a given pressure. Guns are rated according to the volume they *require* at a given pressure.

Terminology is important here as some compressors are rated according to *displacement*, others according to the actual *air delivery*. The air delivery is always the lower figure and the better performance gauge. A compressor with a displacement of about four cubic feet per minute may actually deliver to the gun only 2½—which is what you want to know. The difference between the two ratings is usually around 25 to 35 percent.

Gun requirements fortunately allow some leeway. A typical gun rating may vary from 1½ to 2½ cubic feet per minute on volume and from 20 to 45 pounds per square inch on pressure.

Where a compressor is just barely putting out the minimum that a gun requires, the length and diameter of the air hose become very important. Fifty feet of hose can actually cut pressure in half.

To minimize the loss of pressure, keep the hose as short as possible and favor a large diameter over a small one. If you buy a matched unit complete with hose, you usually need not worry. If you do your own matching, guide yourself by the pressure-drop chart printed with this article.

In some cases, guns are rated simply according to the power of the compressor required to operate them, as: "for use

[*Continued on page 252*]

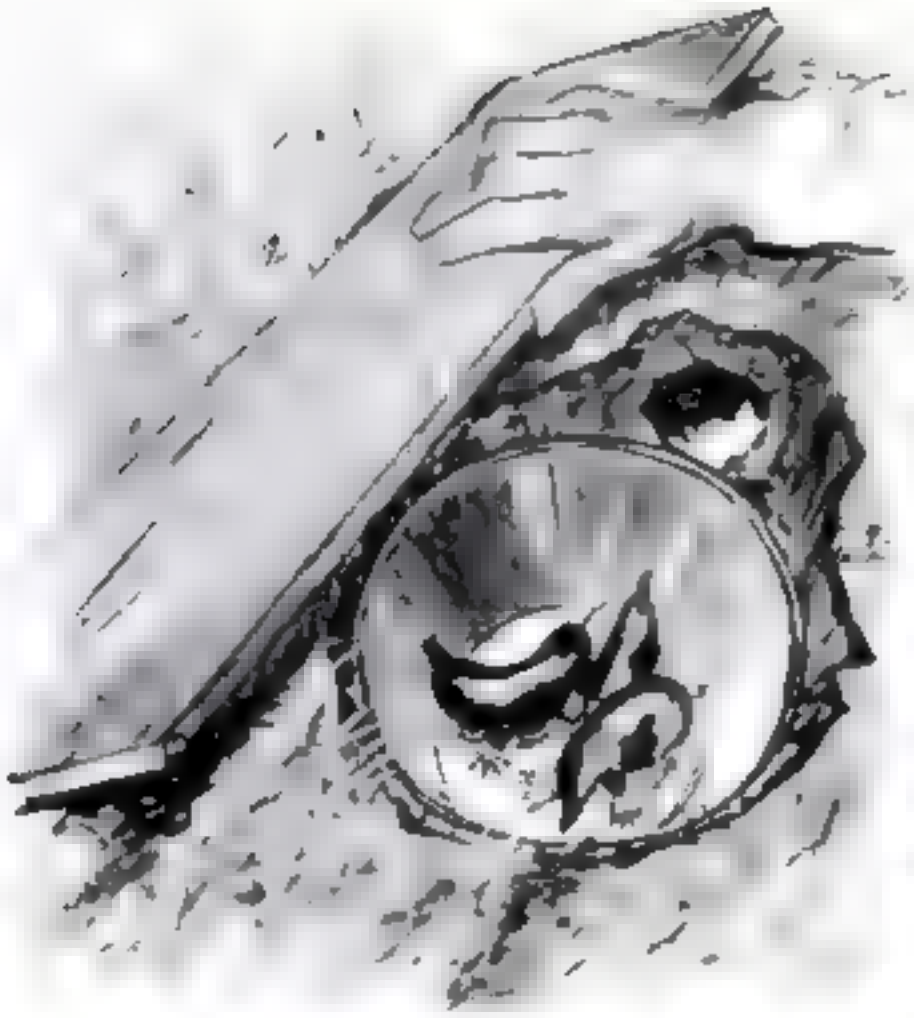
How One Man Pumped Paint Between His House Shingles

IN PAINTING the exterior of my cedar-shingle house, I found it very difficult to force paint between the shingles with a brush.

Then I had an idea. I filled a regular pump-type oil can with paint—and *pumped* paint into the cracks. I first painted the shingle edges by going along with the pump can in one hand and a 4" brush in the other. Then I went back and finished the surface of the shingles. The work went twice as fast as it would have with a brush alone.—*Gordon W. McPhail, Auburn, Maine.*

Short Cuts and Tips

FROM PS READERS

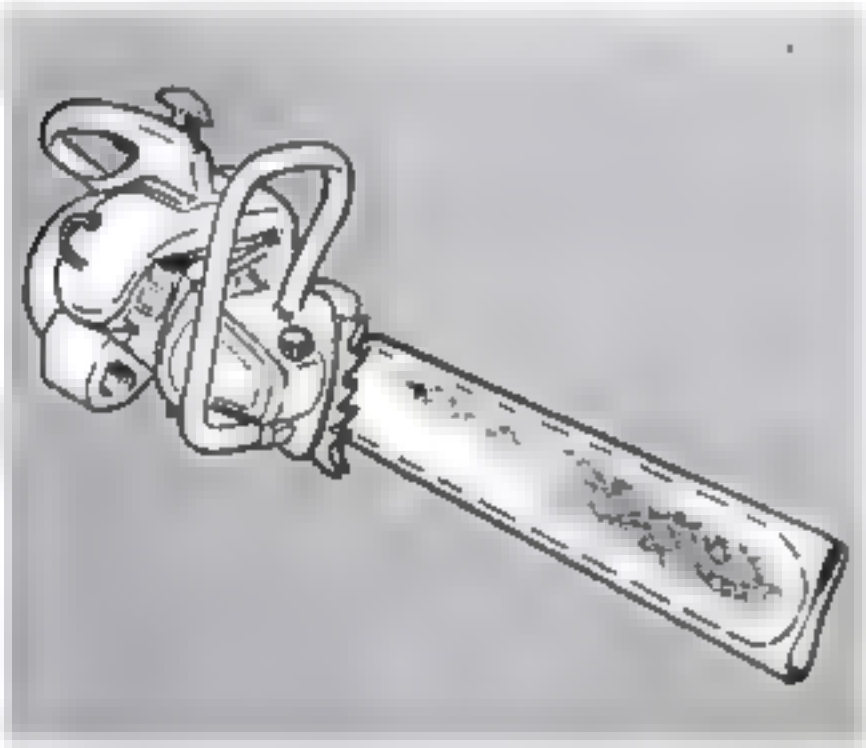


Trapping Moles the Sure Way

IF MOLES in your lawn or garden are troubling you, find the raised tunnel and dig a hole through it big enough for a gallon can. Remove the lid and sink the can until the lip is below the tunnel bottom. Place a board over the opening. Moles using the tunnel will drop into the can, which will be too deep for them to escape from.—*John Krill, North Lima, Ohio.*

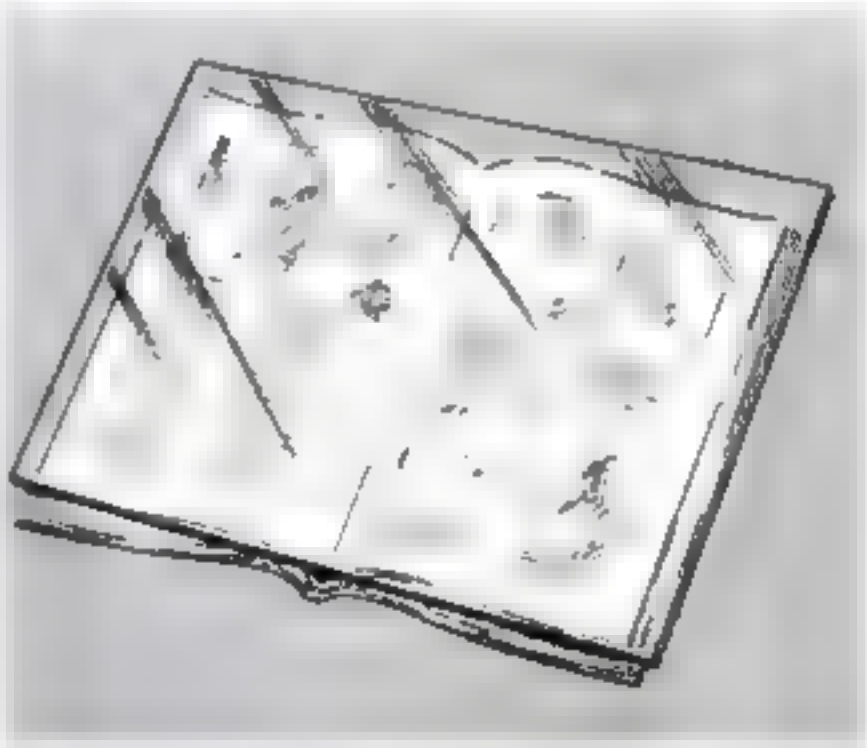
Offsetting for Slight Taper

WHEN you have need to turn a very slight taper, such as for the shank of a mandrel, try placing a thin paper or metal shim under the tailstock on the flat way of the lathe bed. It will tilt the tailstock off the true center axis and can be quickly removed when you want to return the lathe to normal parallel operation.—*H. J. Gerber, Stillwater, Okla.*



Guard for Chain-Saw Blade

HERE'S how you can protect your chain saw from dirt, damage and accidentally injuring someone. From an old truck inner tube cut a section about 10" longer than the blade and slip it on over the blade. It will keep the bar and chain clean and help to cushion knocks and jars.—*James Kane, Cleveland.*

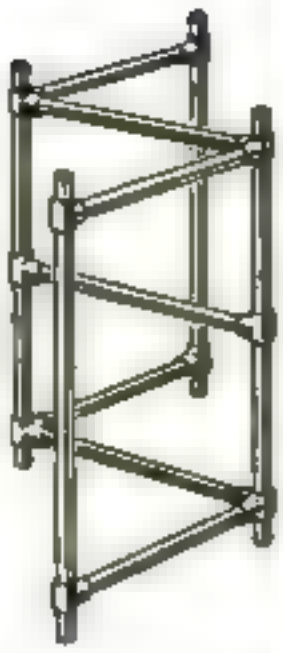


Protecting Magazine Pages

SOLDER-SPATTERED pages and oil spots on important dimensions are the fate of many issues of POPULAR SCIENCE when you build projects from its pages.

A small sheet of clear plastic 1/8" or so thick laid across the open magazine will hold the place and keep it clean.—*R. L. Clough Jr., Bristol, N. H.*

It's a dining room table—



HOW YOU CAN BUILD

A Set of Triple-Use Furniture

By Paul Corey

A SET of shelves, a coffee table, a dining table—you can now assemble any one of three pieces of furniture from the same set of parts. You can also switch back and forth as often as you wish.

You may, perhaps, use the parts routinely as shelves. But when guests drop in, you can convert in a jiffy to a mammoth coffee table or a dining table for eight—whichever you need the most.

Depending upon the lumber and the pipe or tubing you use, the materials will run between $40 and $70. Admittedly, that's a lot more than you'd pay for the makings of a comparable set of shelves or either kind of table. But it's still a bargain price to pay for the convenience of having any one of the three at a moment's notice. Added to that, whichever way you arrange the components there's no makeshift look about them—each piece is distinctively styled. And where space is tight, you have two tables that can be stored in the open as shelves.

How it works. Two zigzag frames, made either of aluminum or iron pipe or tubing, are the supporting members for the three-in-one unit. Facing one another in upright position, they hold a three-section plank at conventional dining-table height. Placed end-to-end, they provide a rack that spaces the planks to form a set of shelves. Flipped on their

WHAT YOU NEED

3 2"x12"x76" dressed planks

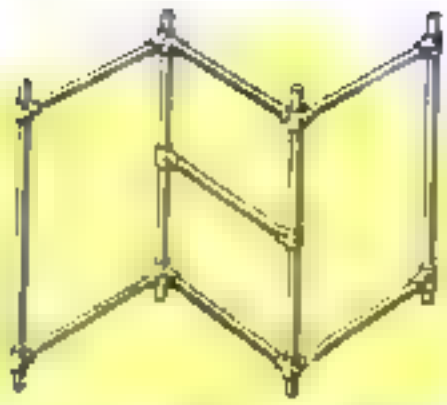
4 10' lengths ¾" pipe or 1" tubing

12 ¾"-pipe tees

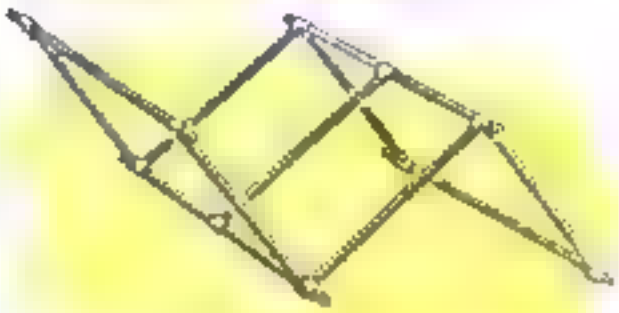
8 ¾" side-outlet pipe tees

16 ¾"-pipe drive-in plugs

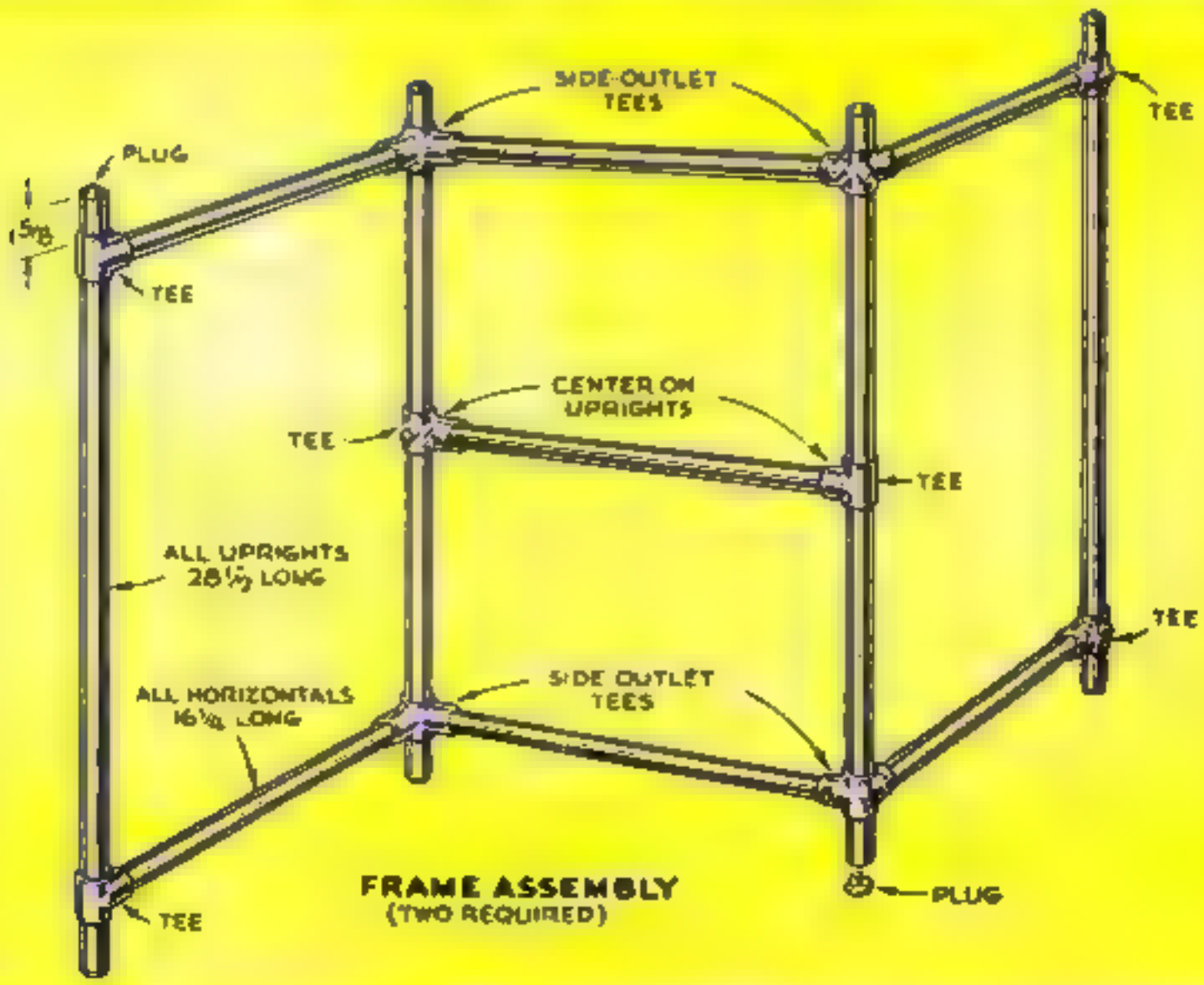
The slip-on fittings shown are available from John H. Hosking Co., 1704 Howland Ave., Cincinnati 23. They also offer cut-to-size, internally ribbed aluminum pipe.



a set of shelves



a coffee table

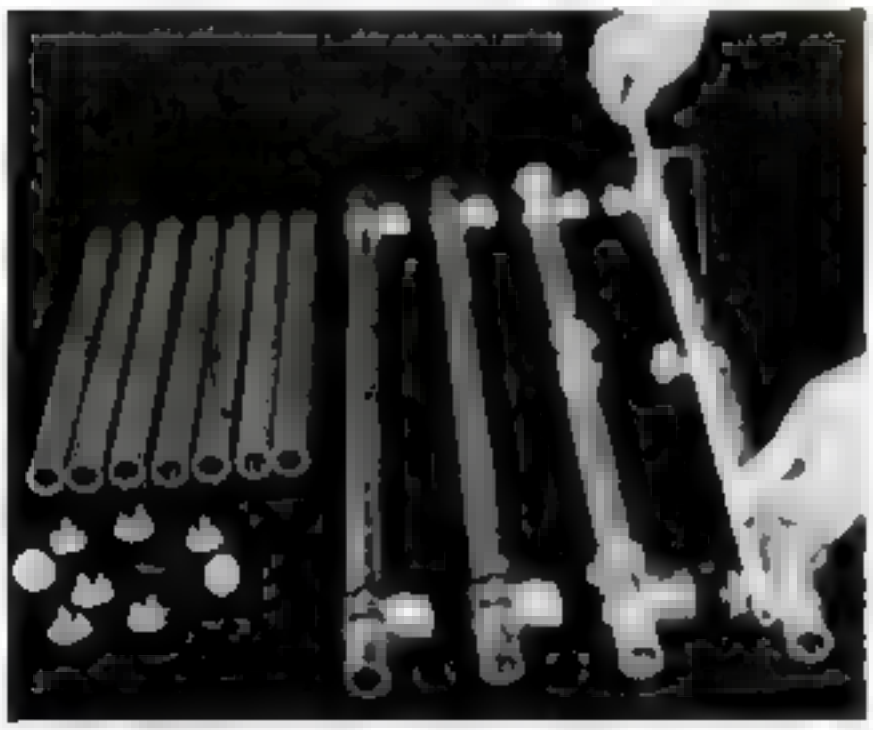


FRAME ASSEMBLY
(TWO REQUIRED)

sides, they're the trestle legs for the coffee table.

Aluminum fittings speed the job. Even if you cut some of the parts yourself, you can build this three-in-one unit in just a few hours, using setscrew-fastened aluminum fittings of types now being offered for industrial scaffold and rack construction. The tees, side-outlet tees and end plugs you'll need come to $23.

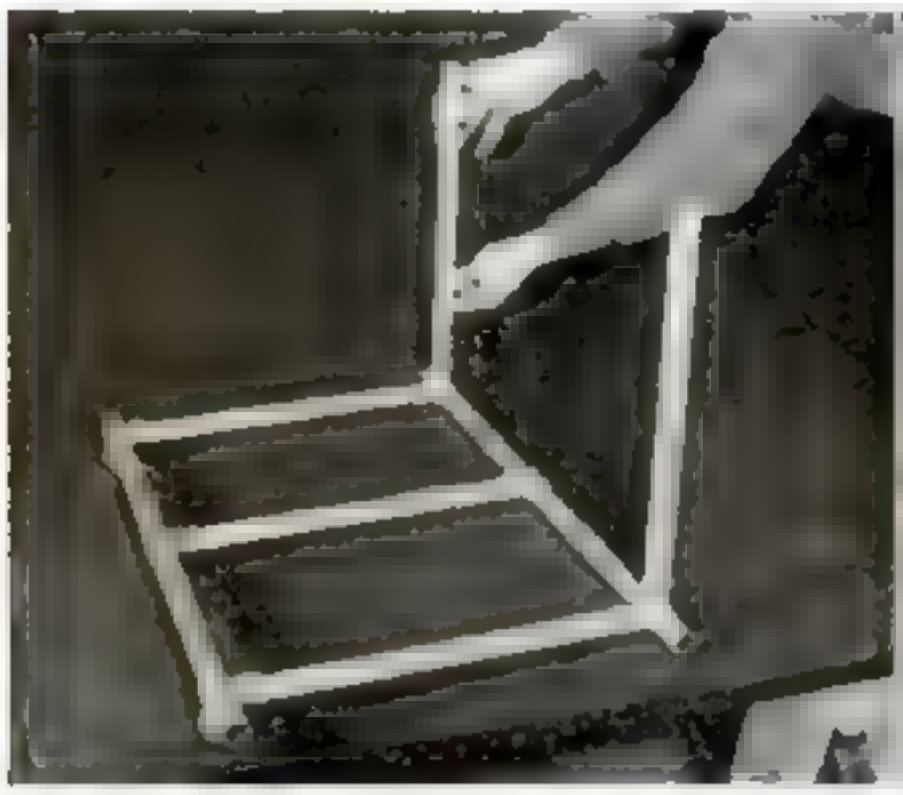
Four 10′ lengths of ¾″ pipe or 1″ tubing will take care of the framework—use two for the 16¼″ sections and the other pair for the 28½ inchers. Don't let pipe and tubing sizes confuse you. Pipe is identified by its nominal *inside* diameter, tubing by its *outside* diameter. One-inch tubing and ¾″ pipe have the same "o.d." and both are right for ¾″ pipe fittings.



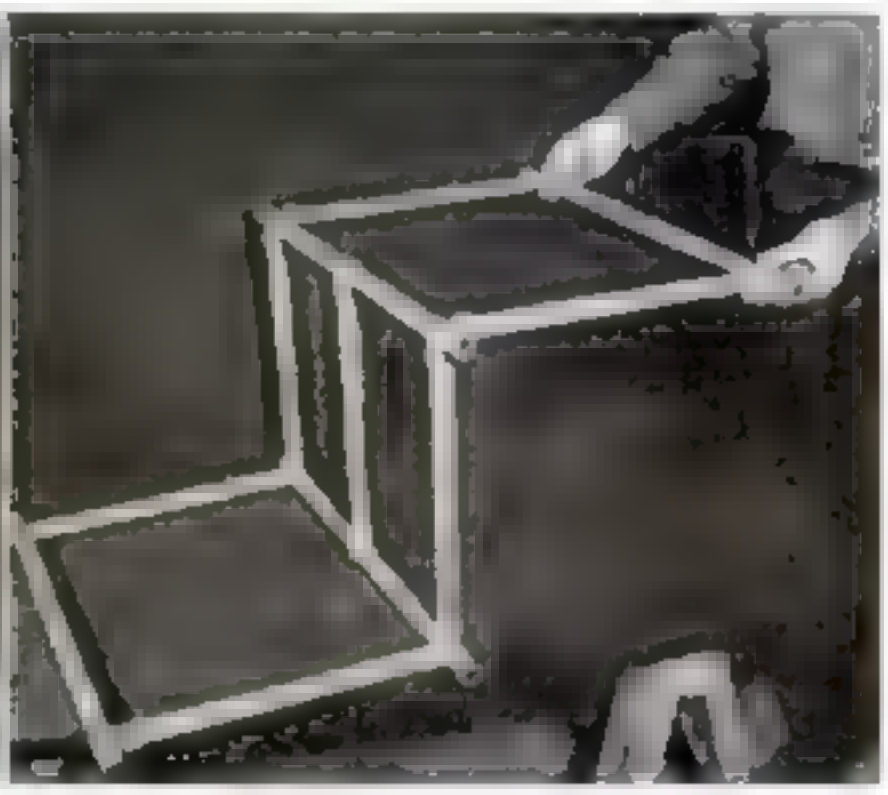
FOR EACH FRAME, use seven 16¼″ lengths of pipe or tubing and four 28½″ lengths. Tees are fastened 1⅝″ from the ends of two long pieces, at centers of the other two. Side-outlet tees are mounted 1⅝″ from the ends of the latter sections. Plugs close off the ends.

Black iron pipe is cheapest—about $7.50 for 40 feet. Galvanized iron costs a bit more, and light, 1″ aluminum *tubing* will come to around $11. A heavier, internally ribbed aluminum *pipe* is also available, in cut-to-length sections, for $17. If you use aluminum, rub it down with 000-grade steel wool, then buff it. Flat-black lacquer is the treatment for iron pipe; leave the fittings in bright aluminum for contrast. Finish the framework by cutting four pieces of ¾″ garden hose, each 2″ long. These are for coffee-table use. Slit and snap them over the two top end supports to keep the planks from slipping

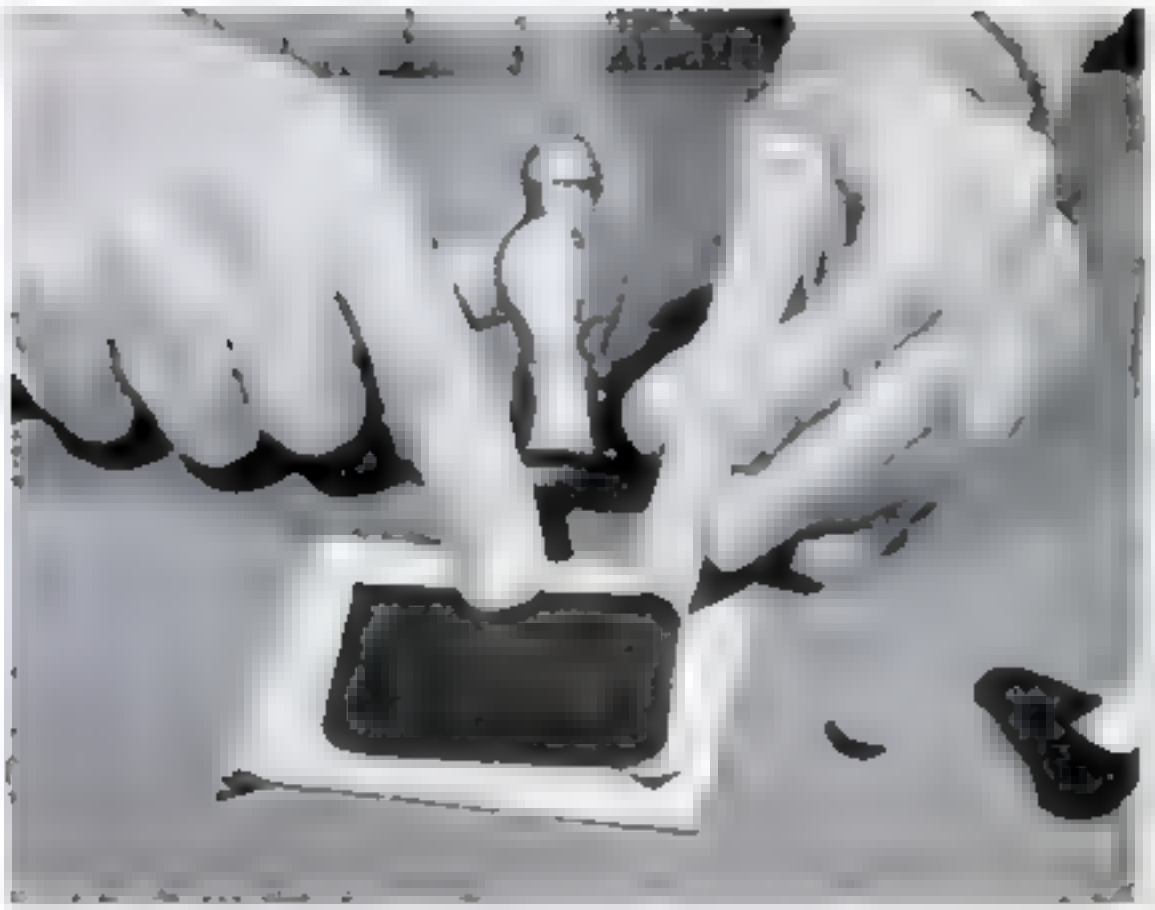
The wood you need. A 20′ length of two-by-twelve gives you the material for three 76″-long shelf and table planks, with allowance for possible end checking. To save laborious planing and sanding, buy select, dressed stock. Redwood, white wood, sugar pine or oak are all good choices. Prices for these are about 70¢, $1, $1.20 and $1.50 a running foot, respectively. Choose a finish to suit your room decor. If you want to get your three-in-one furniture in shape for use fast, give it two or three coats of clear lacquer.



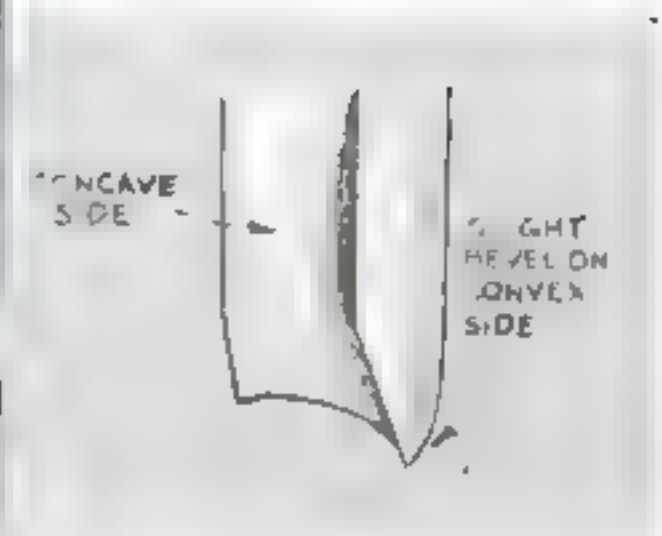
CONNECT THE THREE-FITTING UPRIGHTS with short pipe or tubing sections, reversing the direction of the side-outlet tees. Next, slip the ends of two more short sections into the upward-facing side-outlet tees. Then flip the assembly and attach the other two short pipes.



LONG SECTIONS WITH CONVENTIONAL TEES close off outer ends of each frame. During assembly make sure that setscrew positions conform with those shown in this photo for least conspicuous placement. Check alignment, too, before final tightening with an Allen wrench. END



Short Cuts and Tips
FROM PS READERS



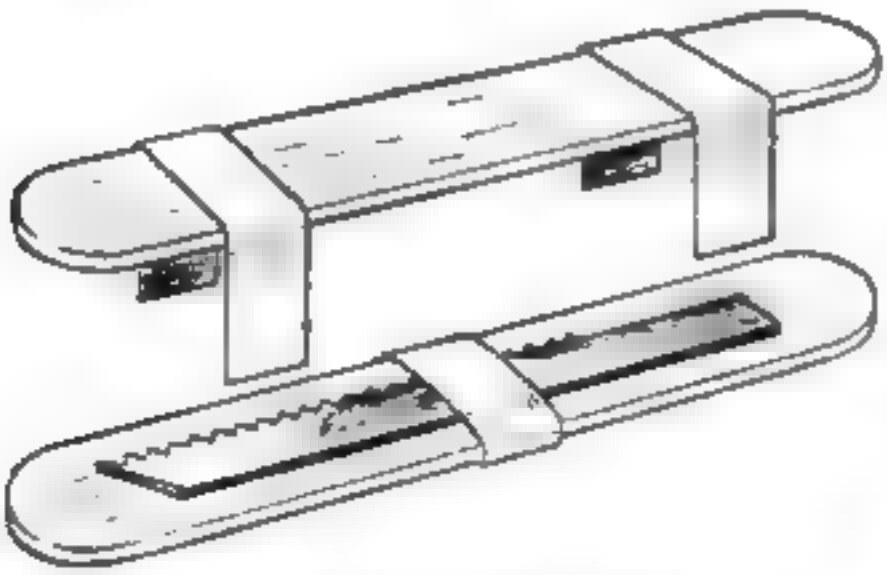
Making Chisels Out of Bamboo

EMERGENCY chisels for cutting leather, felt and similar materials can be made from bamboo. You will find them especially good for rounding corners. First split a 4" length into quarters, and then bevel the concave side of one end with a sharp knife to produce a cutting edge of about 35 degrees. Bevel the convex side slightly with fine sandpaper.

Rest the material to be cut on cardboard or paper over a hardboard sheet. Tap the chisel just hard enough to cut. The edge can be resharpened when necessary.—*Walter E. Burton, Akron, Ohio.*

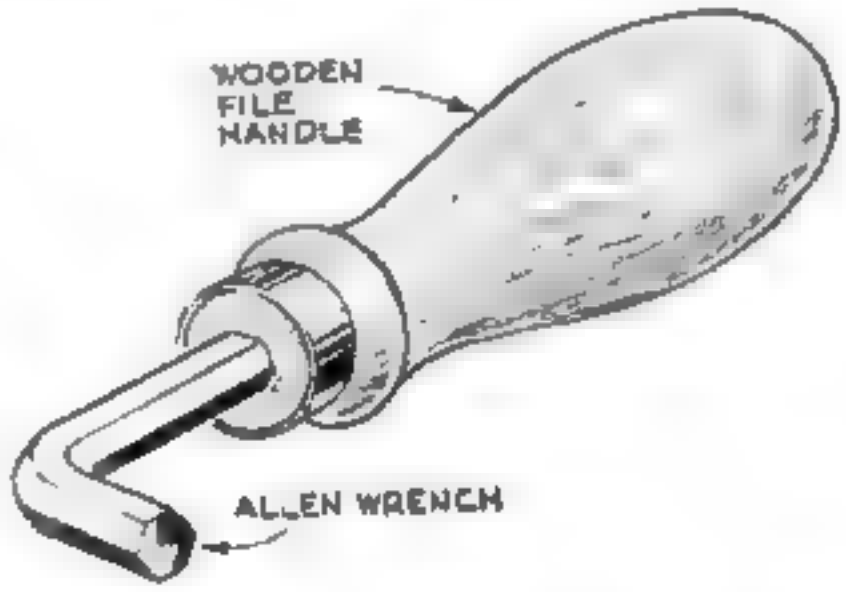
▸▸▸QUICKER than with a hammer, you can sink glazier's points in cellar-window and storm sash with slip-joint pliers or a plier wrench. You can use the idea also for sinking points in the mullions and transoms of double-hung windows.—*Catherine Williams, Connellsville, Pa.*

▸▸▸A FAVORITE container for bolts, nails and other small parts is a glass jar, but it will often promote rusting. You can prevent this by prying the waxed cardboard out of the cover, dampening the inside with light oil, and then replacing.—*R. L. Clough Jr., Bristol, N. H.*



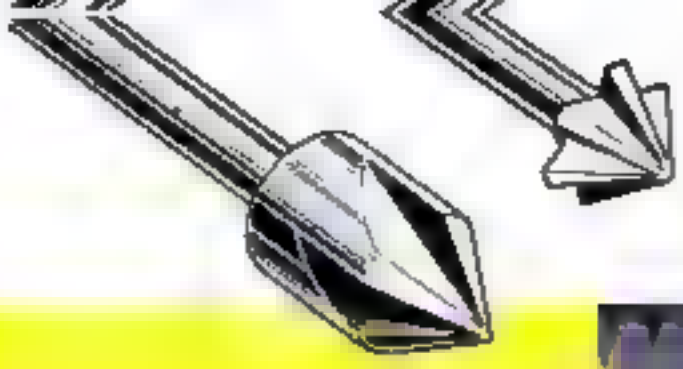
Protecting Small Saw Blades

TO PREVENT damage to saber-saw blades from other tools in my tool box, I tape them to tongue depressors. After taping a blade to one depressor, I place another depressor on top and tape the two into a sandwich that will protect the teeth.—*Donald Spichuk, Brooklyn, N.Y.*



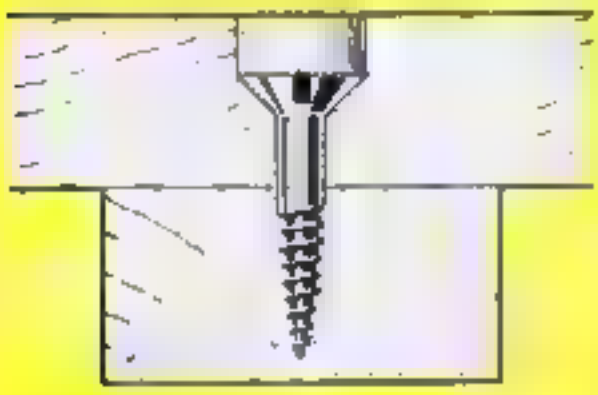
Handy Handle for Allen Wrench

IT TOOK me 15 years as a machinist to discover a convenient handle for Allen wrenches. A simple wooden file handle does the trick. I hit on the idea in desperation when I had to work inside a 6" hand hole in a tanklike structure.—*Herbert C. Myers Jr., Vermilion, Ohio.*

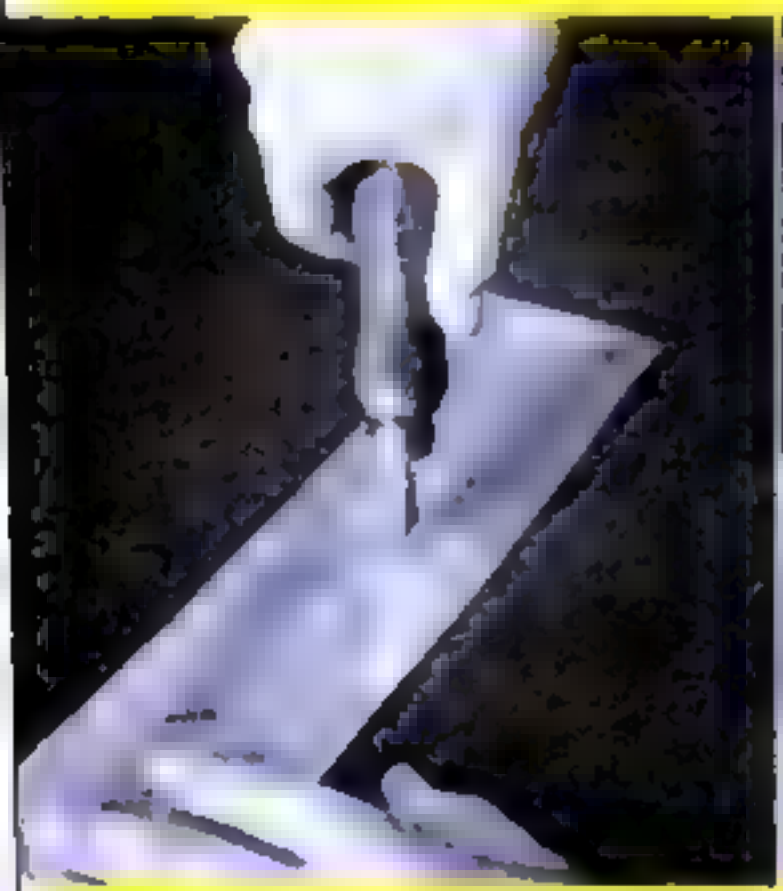


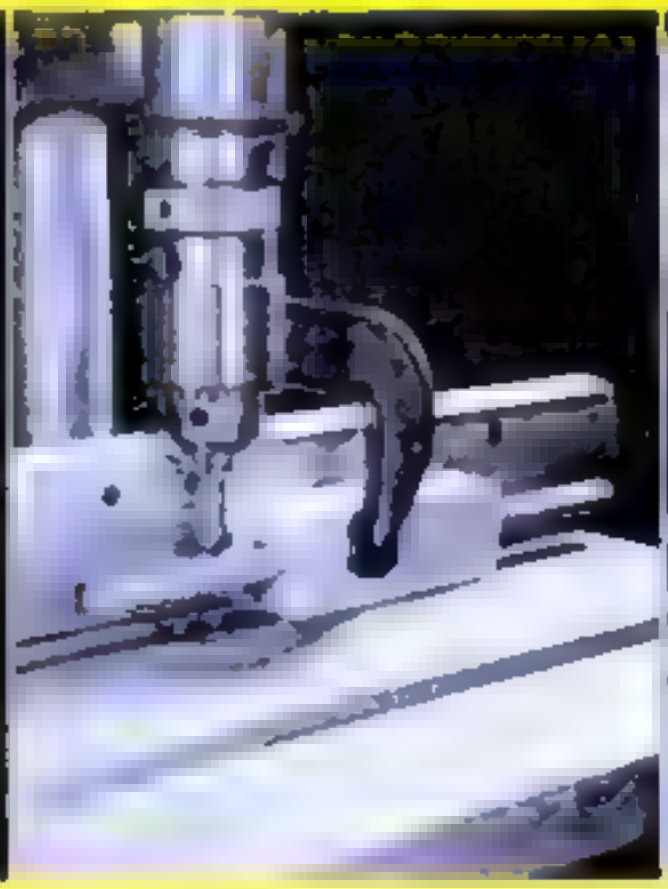
8 Extra Uses

1 Counterboring. When screw heads are to be covered with dowel plugs, continue countersinking until the bit has bored to the desired plug depth. While doing this retract it often—these bits have no provision for clearing waste.



By
R. J. De Cristoforo



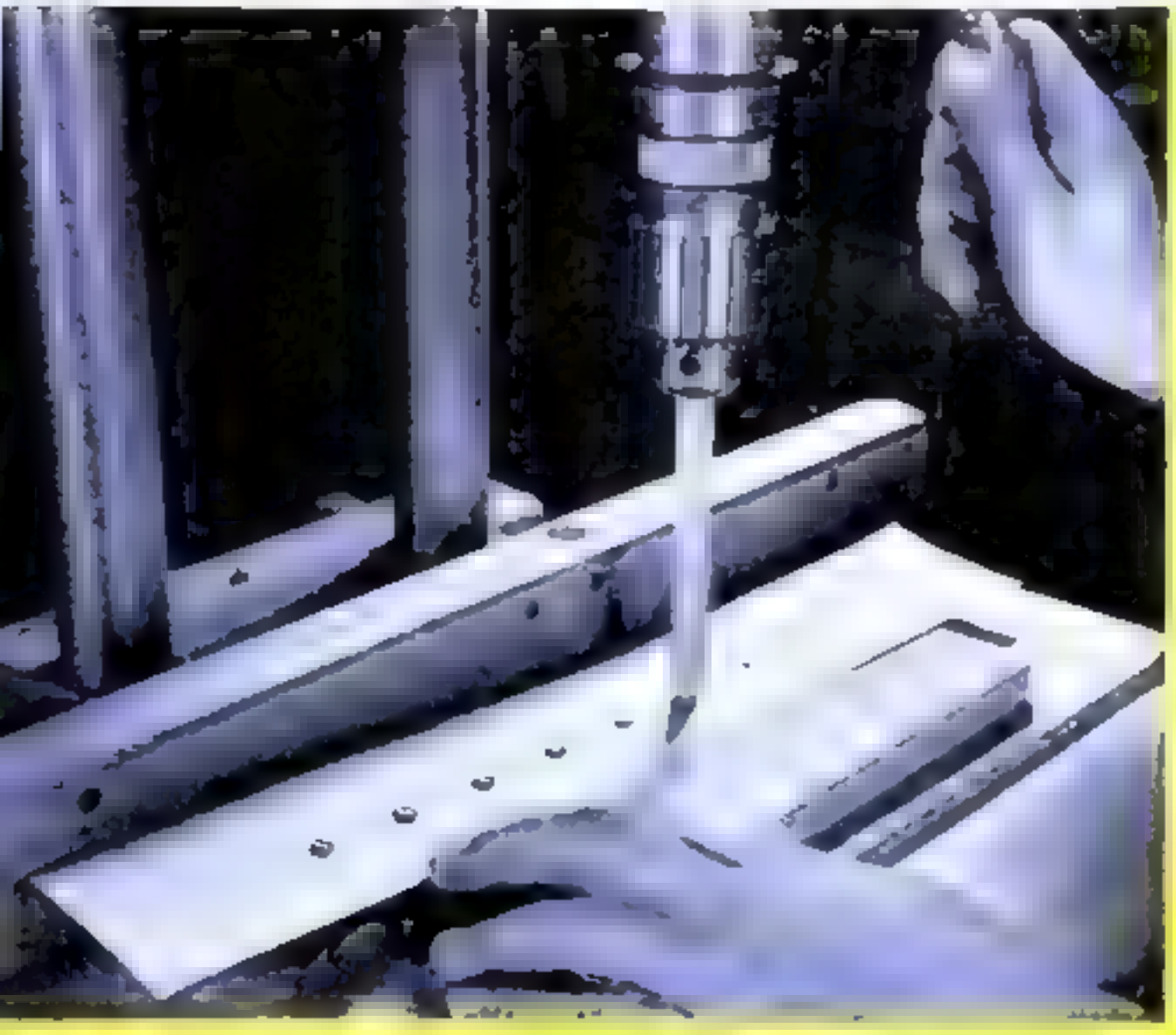


3 Deburring holes. Faster and neater than surface filing, a few twists of a hand-held countersink smooth off the rough, underside edges of holes drilled in thin metal. If you do much of this, put a file handle on the bit.

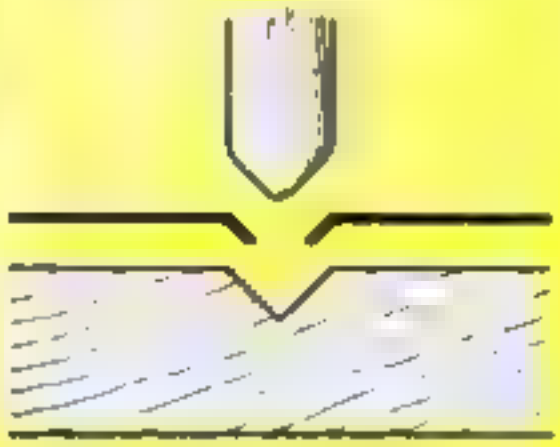
4 Cutting glue grooves. Joints hold better if dowels are channeled to let glue spread. With the setup shown here a countersink, centered above the dowel, grooves the pin as you push it forward, while you turn it at the same time

5 Easy joint assembly. When joining boards edge-to-edge with dowels, countersink the holes and the pins will be guided into any that are slightly mismated. Countersinking also provides pockets to catch glue that is squeezed out

for Countersink Bits



2 Dimpling metal for screw heads. Use this punch-and-die method: First, form a countersink in a scrap block. Then shape a dowel end to match. With the block in place, align the hole and countersink, and push the dowel down.



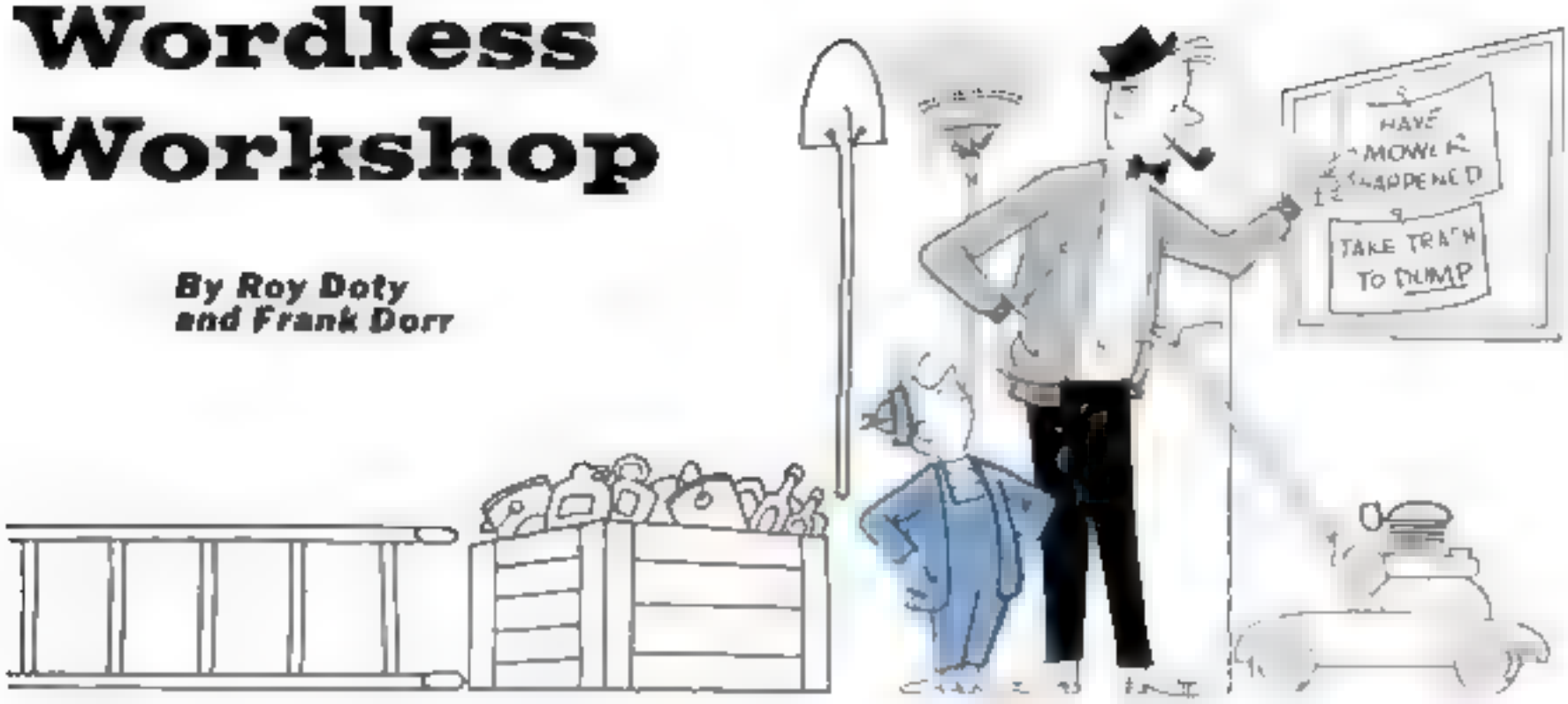
6 Making ornamental trim. Interesting scalloped edges are formed by countersinking equally spaced holes, then cutting along the centerline. By using bits of several sizes and vary the spacing, many types are produced.

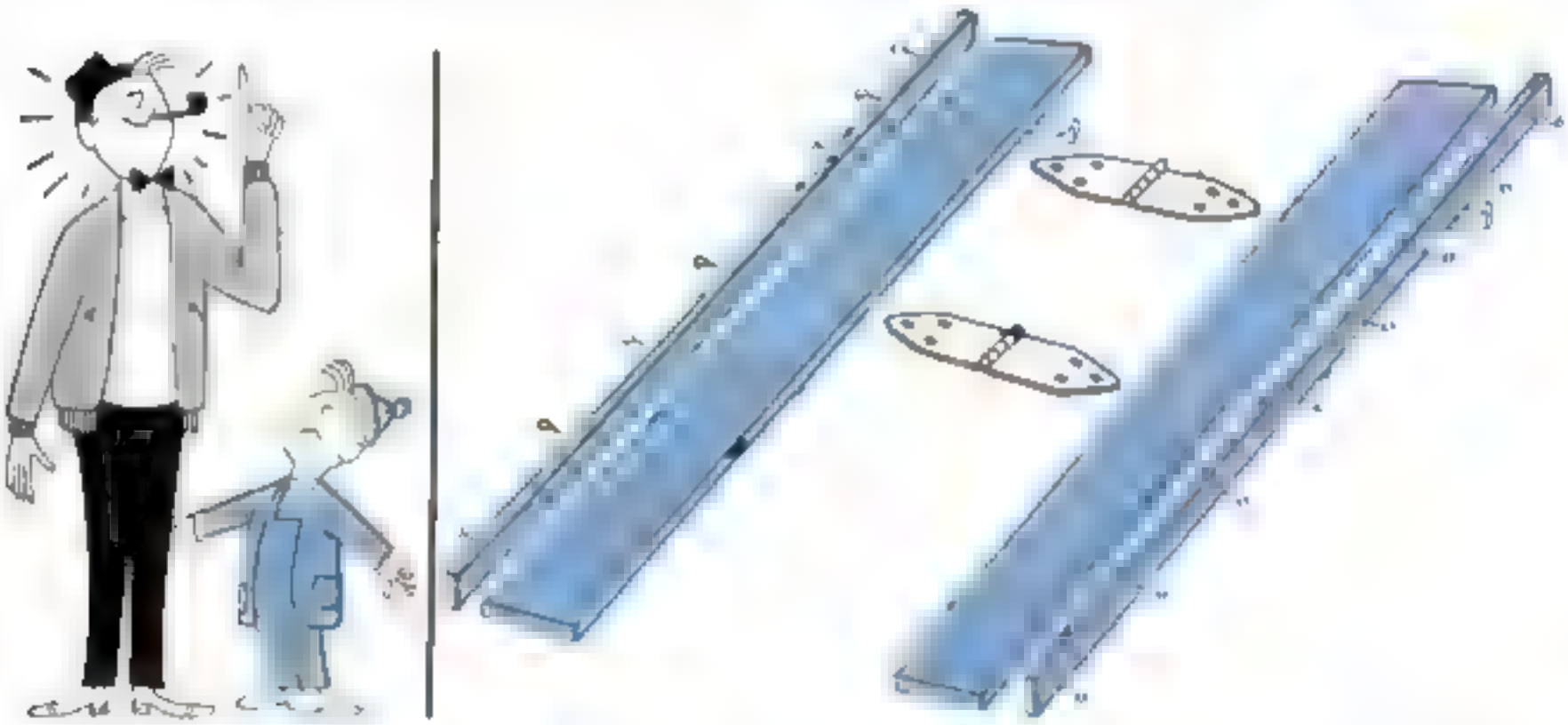
7 Veining panels. Chucked in a drill press and turned at moderately high speed, a countersink can be used as a router bit to cut decorative V grooves. For ones over ⅛" deep, readjust the depth stop and make repeat passes.

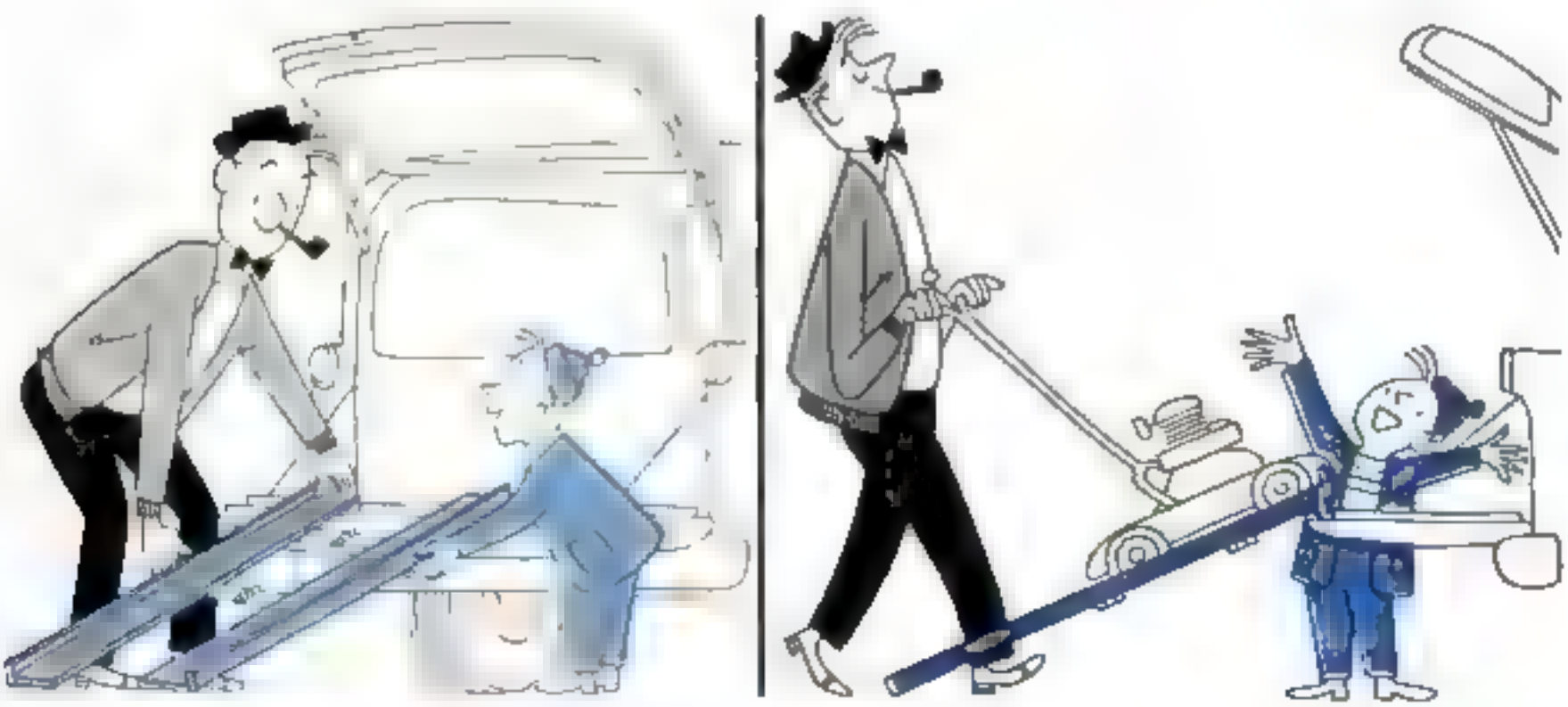
8 Chamfering edges. Doubling as a cutter bit, a countersink does this accurately. A dowel pin embedded in a piece of scrap board clamped to the table may be used to control the position of the work in relation to the spindle center.

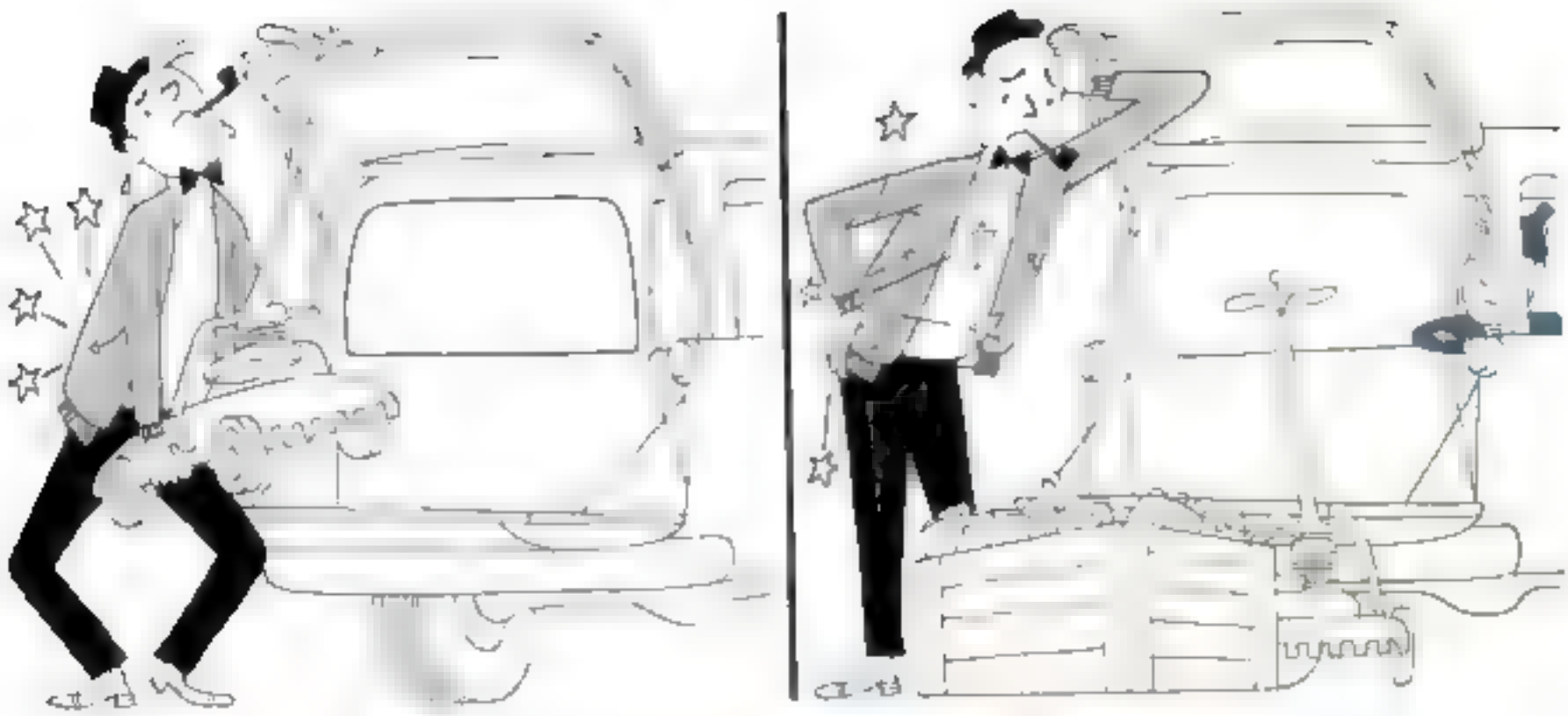
Wordless Workshop

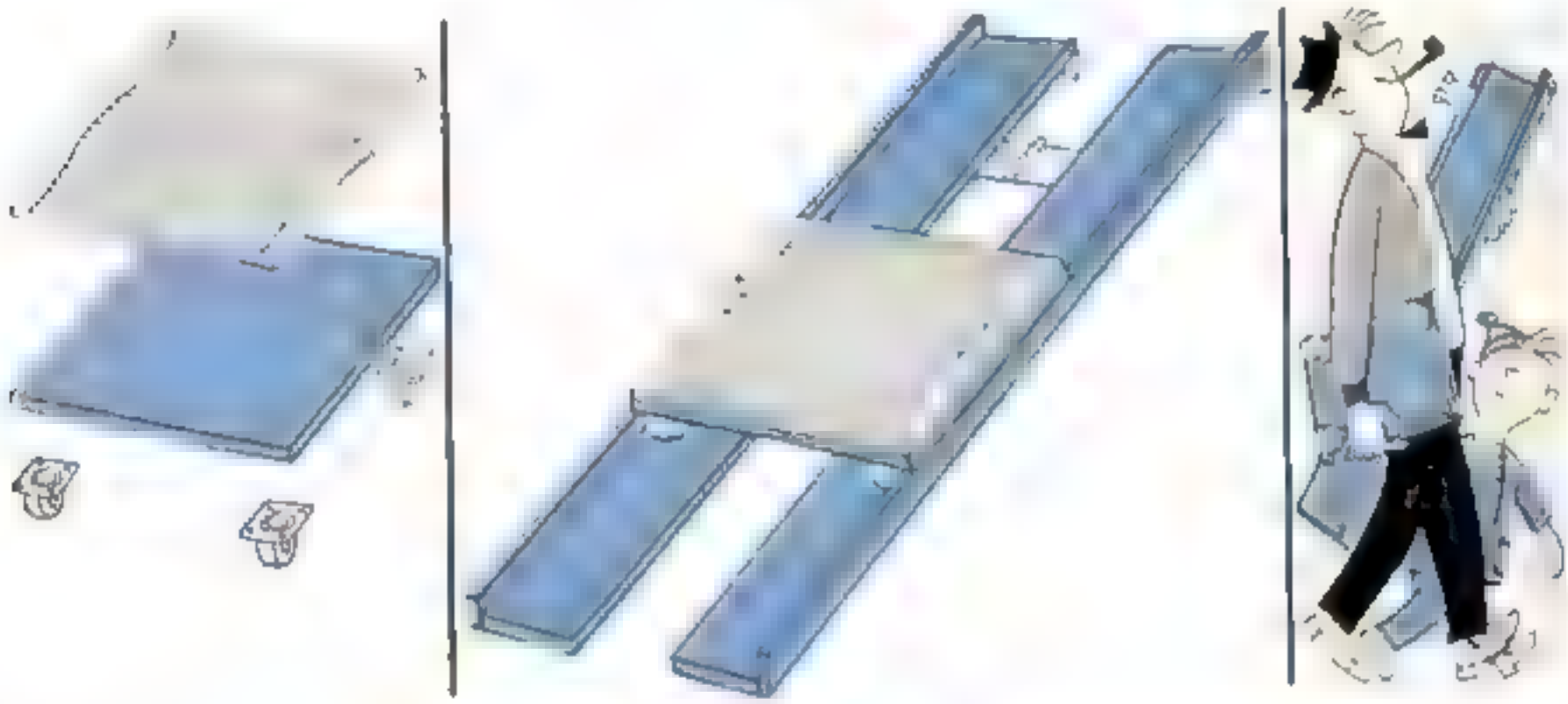
By Roy Doty
and Frank Dorr

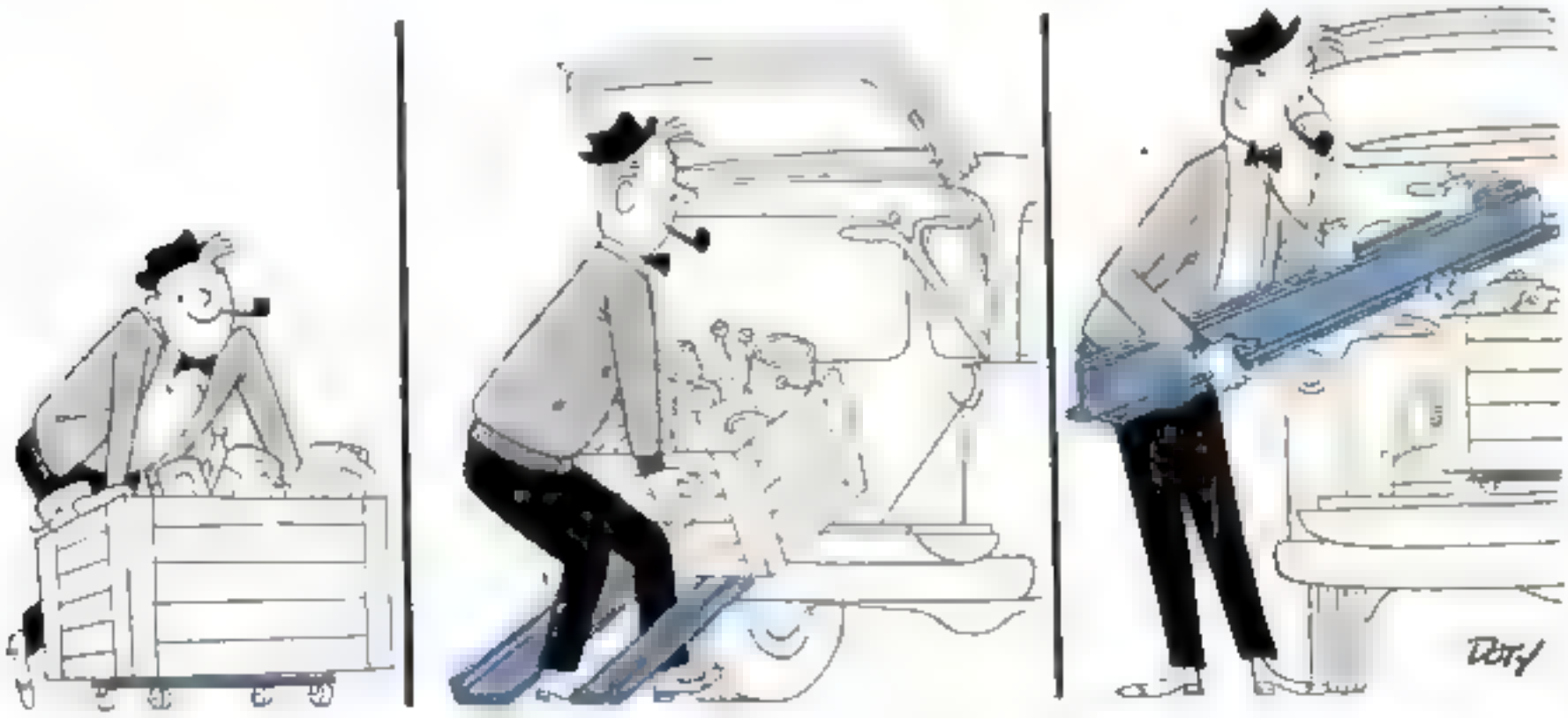




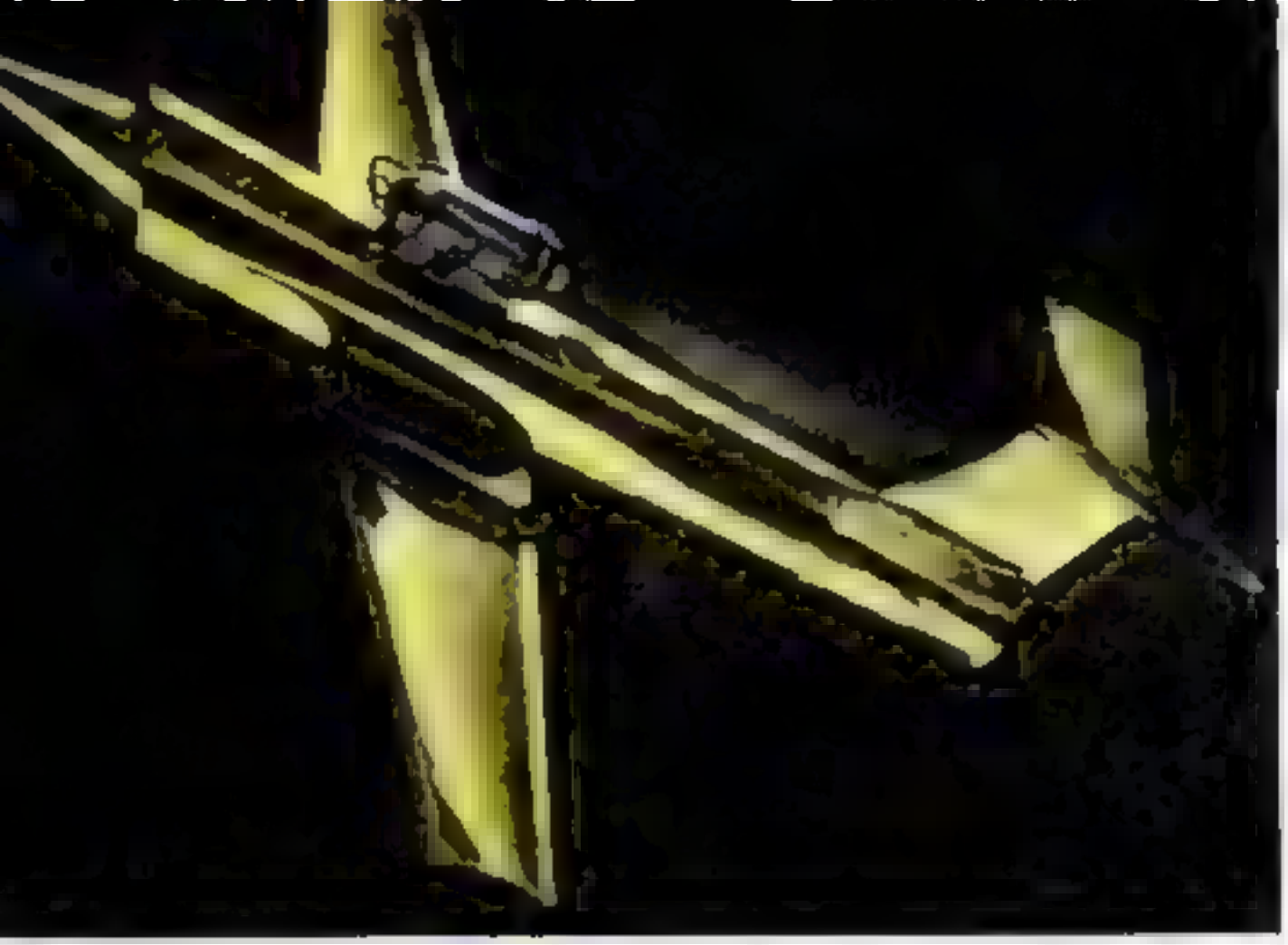


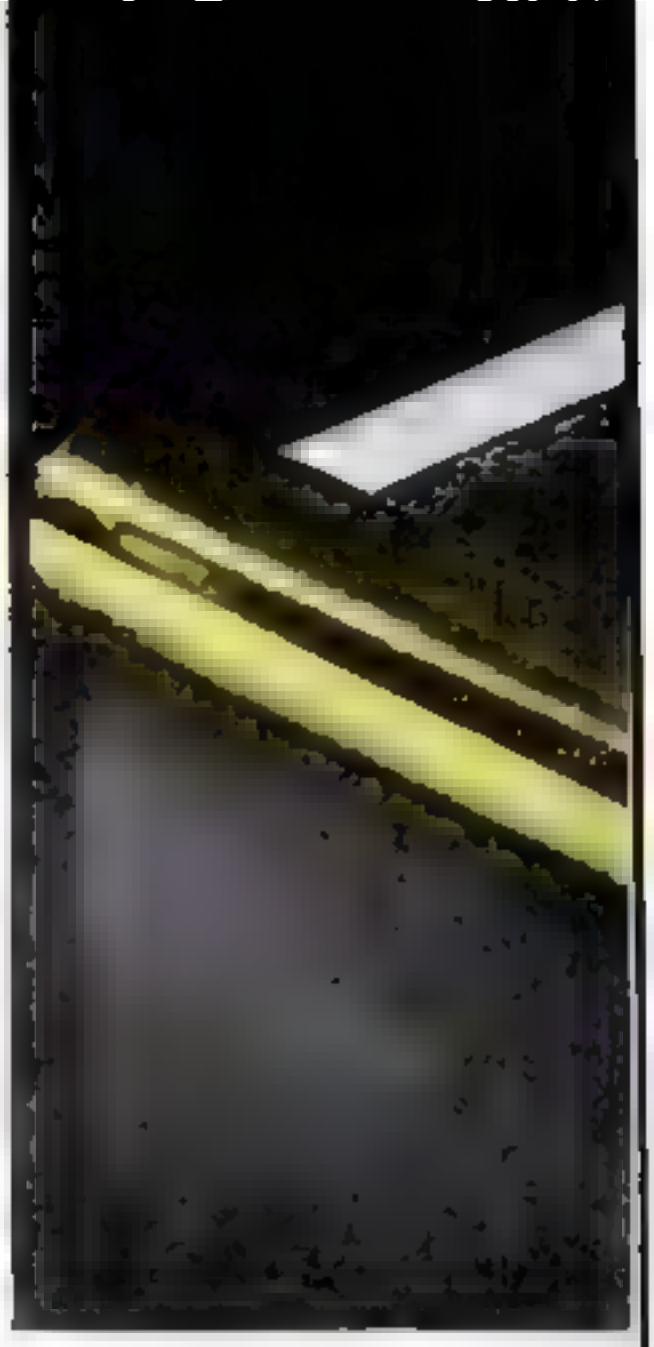






Next Month: A bicycle rack to park wayward two-wheelers





There's a new craft material that's just the thing for—

Building a Metal Tether Jet

By Louis Boury

BRILLIANTLY colored sheet metal can be cut with scissors or a razor blade and assembled in an hour or so to make the fireproof model jet plane shown in simulated flight above.

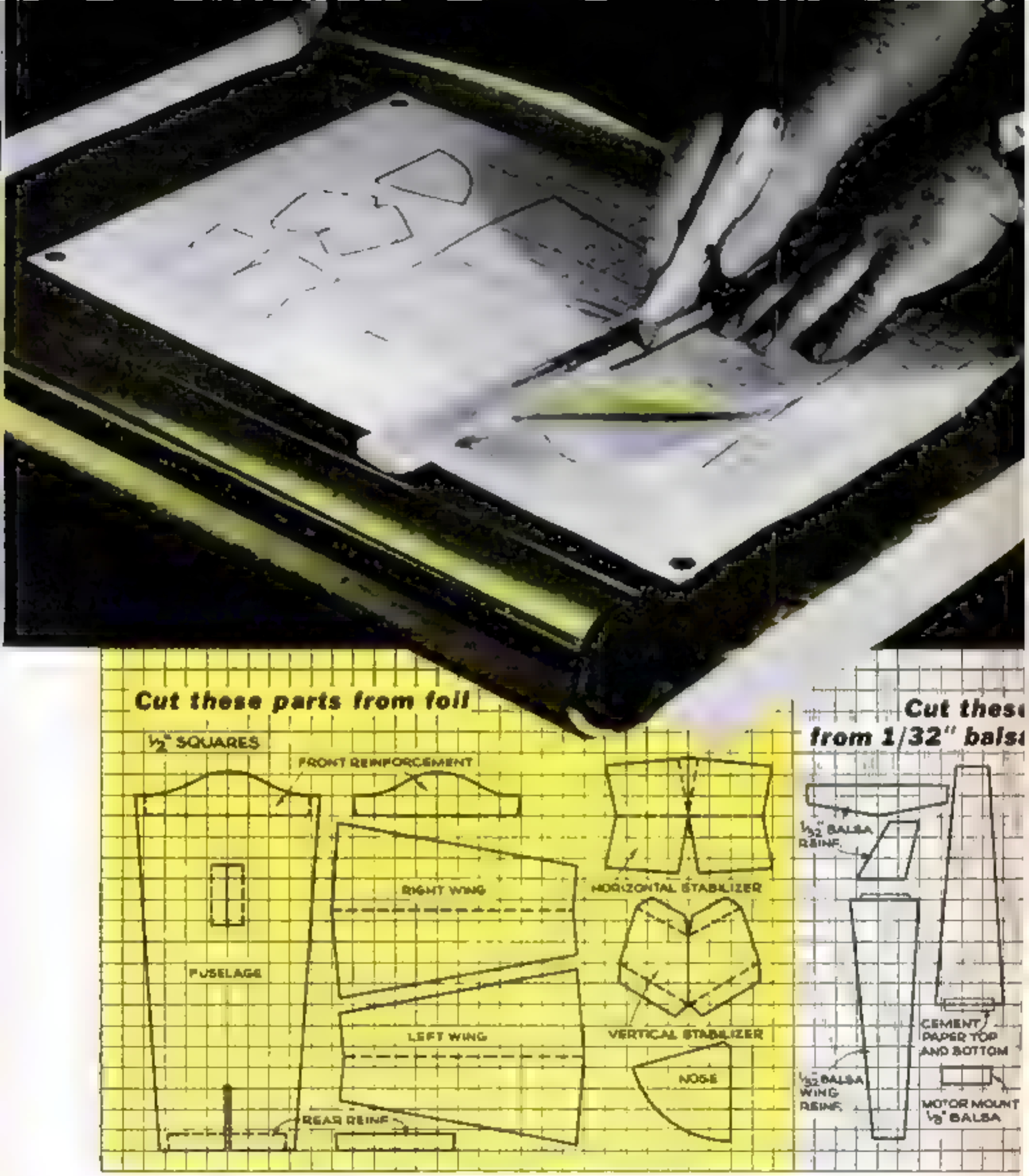
The gleaming metal is about .003" thick—three times thicker than heavy-duty kitchen foil—and comes in practically all colors on one side only. The reverse side is always shiny aluminum. It can be cut and fabricated in the same way as ordinary construction paper, although it is more rigid. Contact cement or a vinyl glue such as "Elmer's" or "Sobo" can be used to join the foil. The prefinished surface requires no protection and can be washed with a damp cloth if soiled.

The colored foil is a craft material formerly used only by window dressers and display makers, but now you may find it at craft and hobby shops or department stores. You can get it by mail from Alufoil Products Co., Inc., 15 Ferry St., NYC 38. A 25"-wide sheet costs about $1 a yard, or you can buy an economy roll 25" wide by 25' long for $5.75.

To build the plane, tape a drawing of the parts to the reverse side of a sheet of foil and tack it to a smooth cutting board. Cut out all the parts, using a straightedge and razor or modeler's knife.

Begin assembly with the fuselage. Cement the reinforcing strip across the front edge; then roll the foil to form the fuselage and cement it together along the bottom, allowing about 1/8" for overlap. Roll a dowel over the seam to make a secure bond. Assemble the tail section over thin (1/32") balsa reinforcement and glue it in place on the rail.

Fold the two wing sections over thin balsa and cement two 15-foot lead-out threads to the left-wing balsa. Then apply glue along the inside of the trailing edges and join. Don't press the wing



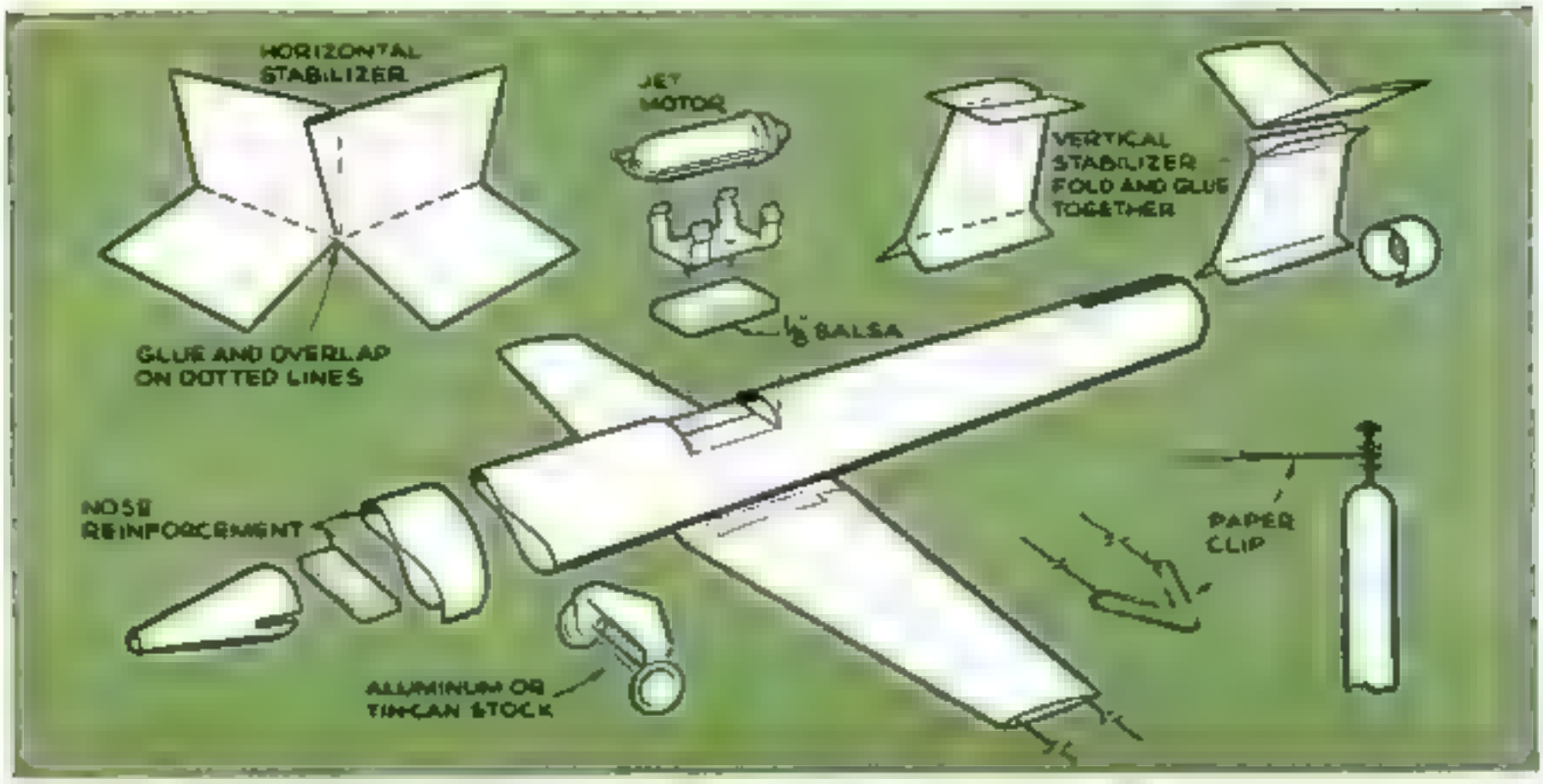
Draw these patterns on a sheet of paper ruled with ½" squares to make full-size cutouts.

material flat; the inherent springiness of the foil will create an airfoil shape along the surfaces. Glue the wings to the underside of the fuselage.

Form and cement the nose over a cone-shaped piece of balsa and glue it in place in the forward fuselage opening.

A small set of wheels mounted on a plastic or tin frame makes the model complete. Glue them to the bottom of the wing near the leading edge.

Jet power for the plane is supplied by



NO DIMENSIONS ARE NEEDED to assemble the parts. Simply cement them in their relative positions as shown. The plane's balance can be adjusted by shifting the motor fore or aft.

a miniature reaction motor called Jetex. These tiny motors use pellets of dry fuel that generate gas under pressure when ignited by a threadlike fuse.

Jetex motors come in several sizes. The number 50B shown on the model supplies ample power for brisk flight. They're available at many hobby shops or direct from American Telasco Ltd., Huntington, N. Y.

Screw the motor clip to a small piece of ⅛" balsa, and glue the balsa in place over the flaps that form the "cockpit."

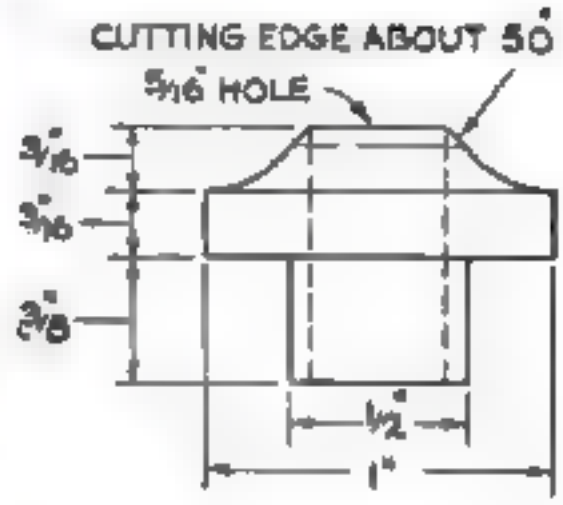
Before flying the plane under power, insert the loaded motor in the clip and swing the plane around you while watching its attitude. If it seems nose heavy, slide the motor back a bit; if tail heavy, move it forward. Once the model is trimmed, attach the threads to a pylon. This can be a stake driven into the ground, or a 12" dowel nailed to a pie tin weighted with plaster or cement. A swivel can be bent from a paper clip.

Set the plane down at the end of the threads, ignite the fuse, and watch for a blur racing around the pylon. No control is needed as the airstream flowing through the tubular fuselage keeps the balanced plane flying level.

WHEN THE FUSE IS LIT, the tiny reaction motor thrusts the plane ahead to take off and fly in rapid circles at the end of 10 or 15 feet of fishing line attached to a stake or dowel. END

Short Cuts and Tips

FROM PS READERS

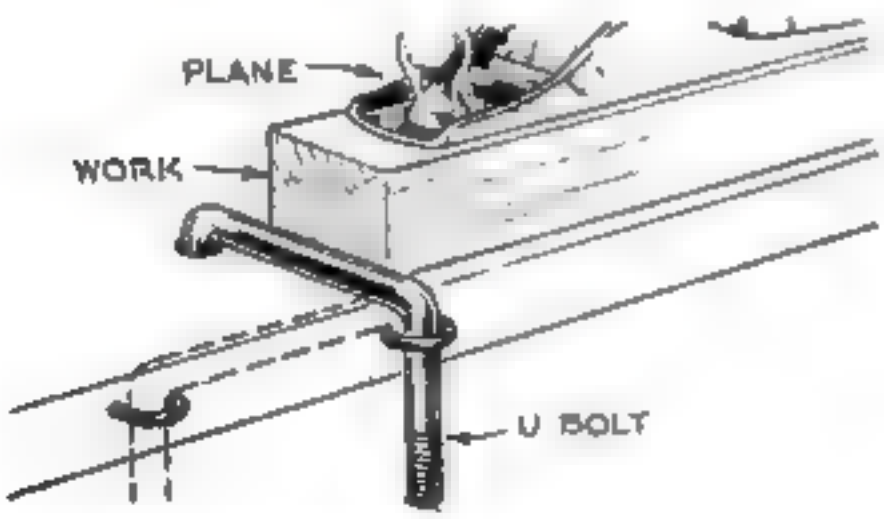


Dies for Cutting Your Own Dowels

You can cut wooden dowels as needed with simple dies machined from steel. Three or four will cover the sizes usually required in the average home shop.

Cut each die into a sort of button with a shank that will fit through a hole in a bench anvil or other sturdy support. The dowel is formed by driving a strip of wood through a cutting end shaped to curl the waste outward. Then force the end through with a punch or a length of smaller dowel or brass or aluminum rod.

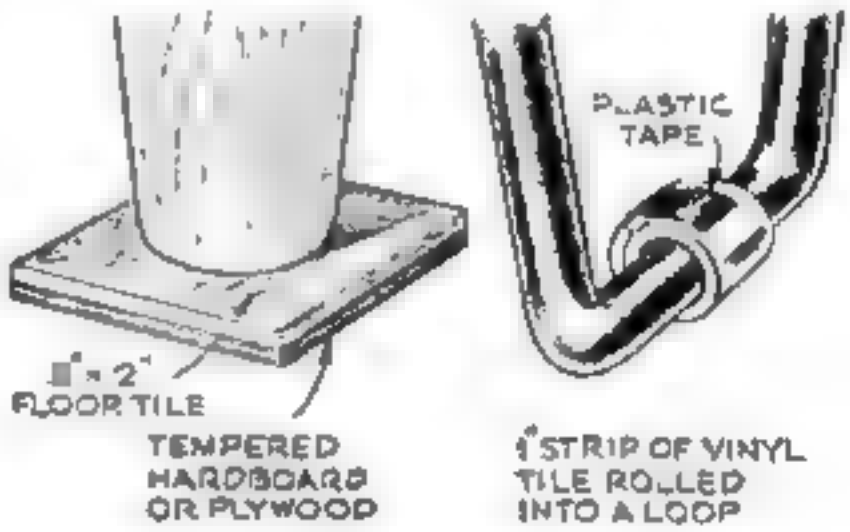
The die can be machined from drill rod, hexagonal or round cold-rolled steel, or a large bolt. Then harden and temper the piece or treat it with case-hardening compound. You will find useful dowel sizes are 1/8", 1/4", 3/16" and 3/8". *—Walter E. Burton, Akron, Ohio.*



U-Bolt Bench Stop

A BENCH stop that will always be available when you need it, but can be swung out of the way when not in use, can be made from a large U bolt.

Drive two staples large enough to accommodate the bolt legs into one edge of the bench for supports, then bore a hole in the top to take one of the legs when the bolt is swung into position as a stop. *—M. Robert Beasley, Jackson, Mich.*



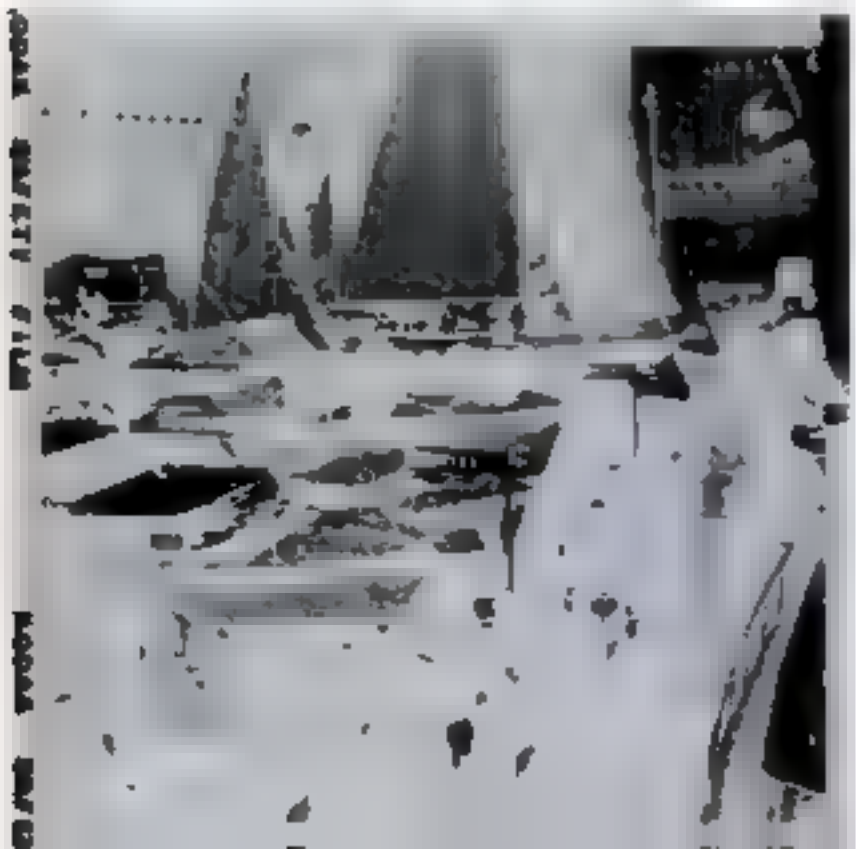
Keeping Dents Out of Floors

FURNITURE legs, either wooden or the wrought-iron kind, will dent any resilient floor in time. "Invisible" coasters for most legs can be made by backing a 2"-by-2" piece of spare tile with a square of hardboard. Hold with mastic.

Curved wrought-iron legs can be cushioned with a ring of bent tile held in shape by plastic tape matching in color. *—Preston Stedman, Kingsville, Tex.*

CANDLES SUPPLIED THE ONLY LIGHT for this hand-held shot at 1/30 sec., f 5.6. The fast shutter speed kept candle flames small; medium lens opening put both cake and faces in focus.

HOW FAST IS THE HIGH-SPEED FILM? Judge for yourself. The properly exposed negative is Royal X Pan; than one is Verichrome Pan. They were made indoors in New York's cavernous Coliseum. Both were exposed for 1/30 sec. at f 5.6; got the same development



A New Look at the Fast Photo Films

Can dubs as well as pros use those new shoot-in-the-dark films? Sure. Try them and see

By Erik H. Arctander
with photos by W. W. Morris

MY NEIGHBOR'S photograph album tells the story of fast films. When you leaf back in it a few years, the indoor shots look as though a spotlight had pinned some ashen-faced people to a dark blanket. But the most recent prints are wonderfully natural. There's a close-up of his son raiding the refrigerator—taken by the light from inside it. Another caught his wife shaping cookie dough on the kitchen counter. There are dozens more, all shot by room light. The soft, even illumination gives them greater warmth than flash photos.

It's the amazing speed of the newer films that makes such photos possible. No tripod, expensive lens or exotic developer is necessary. The new emulsions record virtually anything your eyes see.

By following the tips given here, you can duplicate any photo on these pages, even with an inexpensive camera. Dim-light photography offers exciting possibilities for off-guard family pictures and off-beat experiments that were once impossible. Now your camera will make good photos:

In shadow. The soft, even daylight in the shade of a tree or building is very flattering for portraits. No need to pass up action pictures there, either.

On rainy days. Ordinary scenes take on a different look when glistening rain falls. You can catch action with a fast shutter or increase depth of focus.

At dusk. Go right on shooting the closing minutes of sports scenes, or backyard antics after the sun sets.

At night. Street, car and house lights focus attention dramatically on your subject—without flash. The darkness is like a backdrop that cuts out extraneous background details.

Indoors. Ordinary artificial light is all you need to take crisp action photos or off-guard portraits. A home, arena, theater, restaurant, auditorium, subway, etc., provides the setting.

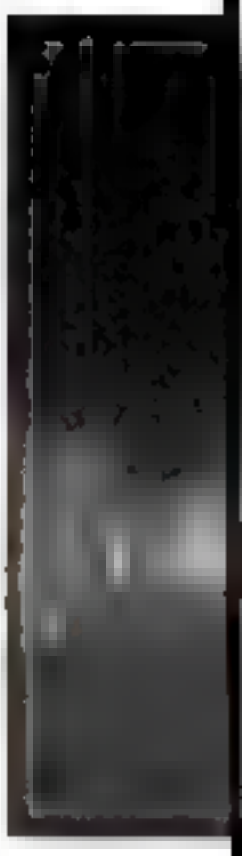
Haven't photographs like this been made for years? Not really. Many pros forced the earlier films way beyond their designed sensitivity with special developing brews. They got startling "available light" pictures, but the clumps of grain on blowups looked like colonies of bacteria under a microscope.

The newest crop of fast films—ranging in speed from A.S.A. 200 to A.S.A. 650—is less than two years old. (Isopan Record, newest of *these*, came on the market just this month.) These eight

A DIM PHONE-BOOTH LIGHT was the sole illumination for this shot at 1/30 sec., f/5.6. The compact mirror in the girl's left hand reflects overhead light onto her face.

BRIGHT STORE WINDOW threw so much light that exposure was made at 1/60 sec., f/8. Stopping down put both the foreground and background in focus.

TWENTY FEET AWAY from the same store window, the light shining from it was still bright enough to snap a street scene at 1/30 sec. and f/8 opening.



black-and-white films offer speed plus good grain, even when commercially developed, if you expose at the rated index.

With a modest developing outfit you can try much higher film speeds. It's perfectly safe to at least double the exposure index. Because of a built-in 2-2½ safety factor, such forcing has only a small effect on the grain pattern. Pros often push the speed ratings as high as five times normal and overdevelop.

Forcing the one fast color film (Super Anscochrome) is a job for experts that you probably won't want to tackle. But the normal exposure index of 100 is plenty fast for most color shots.

Here are some tips to follow when you load the fast black and white.

Match film speed to light. The faster an emulsion, the more grain it shows. So don't use the very fastest film unless you really need the extra speed.

For fast indoor photos you might consider Agfa Isopan Ultra and Perutz Peromnia 25, which have been deliberately made more sensitive to artificial (tungsten) light than to daylight.

Watch the expiration date. The faster a film, the shorter its shelf life. Fast color is even more critical. It keeps best when stored below 55 degrees F. Buy only what you plan to use immediately.

Develop right away. A latent image fades faster on super-speed film. As one manufacturer put it: "You can't take a picture of your wedding and the first child's christening on the same roll and expect both to come out well."

Read the instruction sheet. Unless you use a good exposure meter it's very easy to overexpose fast film. Average exposure suggestions are packed with each roll of film. Kodak goes so far as to warn box-camera users away from its super-fast Royal-X Pan (despite the A.S.A. rating of 650, Kodak recommends an e.i. of 1,600, using a light meter).

Still, a camera with fixed speed and lens opening can handle most high-speed films if the owner has enough patience. The trick is to snap the picture where, according to the instruction sheet, the light available will give a correct exposure at 1/50 sec., f/11. That's the most common box-camera setting.

Expose consistently. Every frame on a roll will get the same development, so you can't switch exposure indexes in mid-roll. If you double the e.i., it must stay doubled all the way through. Sticking a piece of tape with the e.i. on it on your camera is a good reminder.

The pros make sure of getting something usable by bracketing the most likely opening with a stop lower and a stop higher. One of the three negatives that result is usually about right.

It costs less than a dollar to experience once more that original thrill of taking pictures. Have fun.

THE TOUGHEST PICTURE to take was this car interior. Several hand-held shots were made by domelight at 1/15 sec., f/3.5.

STOPPING ACTION IN POOR LIGHT is a natural for fast film. The subdued general lighting in the bowling alley was enough to freeze motion at 1/125 sec. Opening was f/5.6. END

Snapshooter's Guide to the Fast Films

MAKER	FILM	A.S.A. EXPOSURE INDEXES		ROLL-FILM SIZES				
		Daylight	Tungsten	120	620	127	35 mm.	828
AGFA	Isopan Ultra	250	400	✓	✓	✓	✓	
	*Isopan Record	640	Not given	✓			✓	
ANSCO	*Super Hypan	500	400	✓	✓		✓	
	Super Anscochrome Daylight	100	—	✓			✓	
	Tungsten	—	100	✓			✓	✓
ILFORD	HP3	200	160	✓	✓	✓	✓	
	*HPS	400	320	✓	✓	✓	✓	
KODAK	Tri-X	200	160	✓	✓	✓	✓	✓
	*Royal-X Pan	650	Not given	✓	✓			
PERUTZ	Peromnia 25	250	320	✓	✓	✓	✓	

*Use only in adjustable camera

Short Cuts and Tips

FROM PS READERS

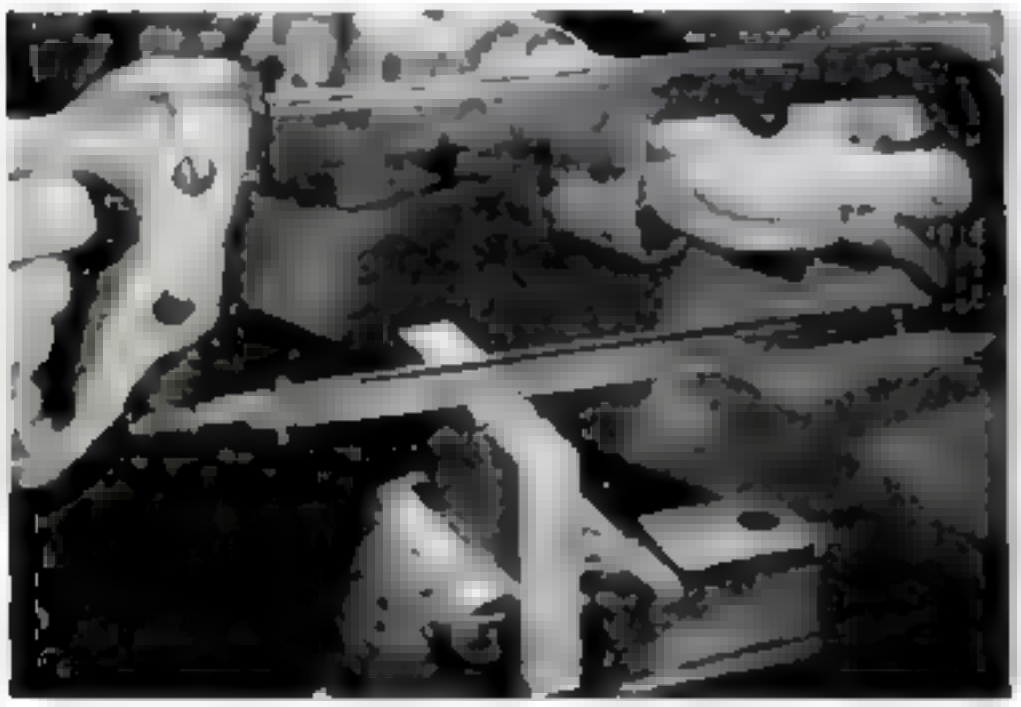
Painting Screwheads

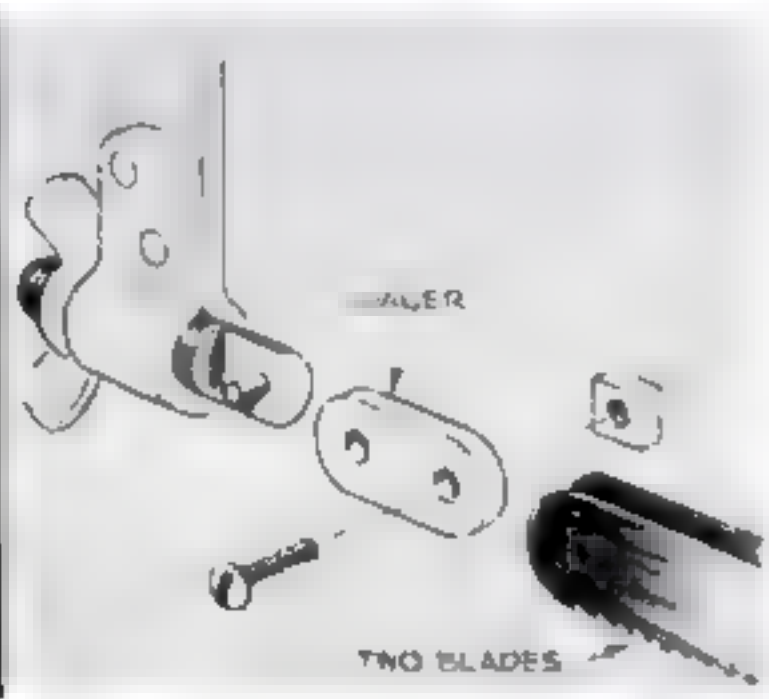
WHEN you paint over countersunk flathead wood screws that are likely to be removed later, it is best to keep the paint from filling the screwdriver slots.

One way to accomplish this is to cover the screwheads with disks of gummed paper before painting. You can cut them with a drive punch. The screwdriver will easily break through when a screw is to be removed.—*William E. Buchner, Toledo.*

Safety Igniter for Oven Burner

I FIND soda straws handy for lighting a kitchen-range oven. The waxed paper burns readily and is long enough to reach the burner without endangering my hand.—*Blanche Campbell, Rivera, Cal.*





Using a Hacksaw to Cut Slots

AN EASY way to cut a slot in wood, plastic or metal is to use two blades in a hacksaw. You can spread them apart simply by inserting a screw, nail or other separator near each end. If a tendency of one blade to bow interferes with work, you can make a special separator like that in the drawing by drilling a short piece of metal to fit the holder and take a small bolt to hold the blades.

This setup is useful also for sawing large pieces of sheet metal. As the work progresses, bend the strip between kerfs down and out of the way so the back of the frame will go easily through the cut. —*Wilfred E. Berkeley, Cleveland.*

You'll have more fun afloat, and avoid trouble ashore, if you follow all the rules that add up to—

The Right Way to Heft an Outboard

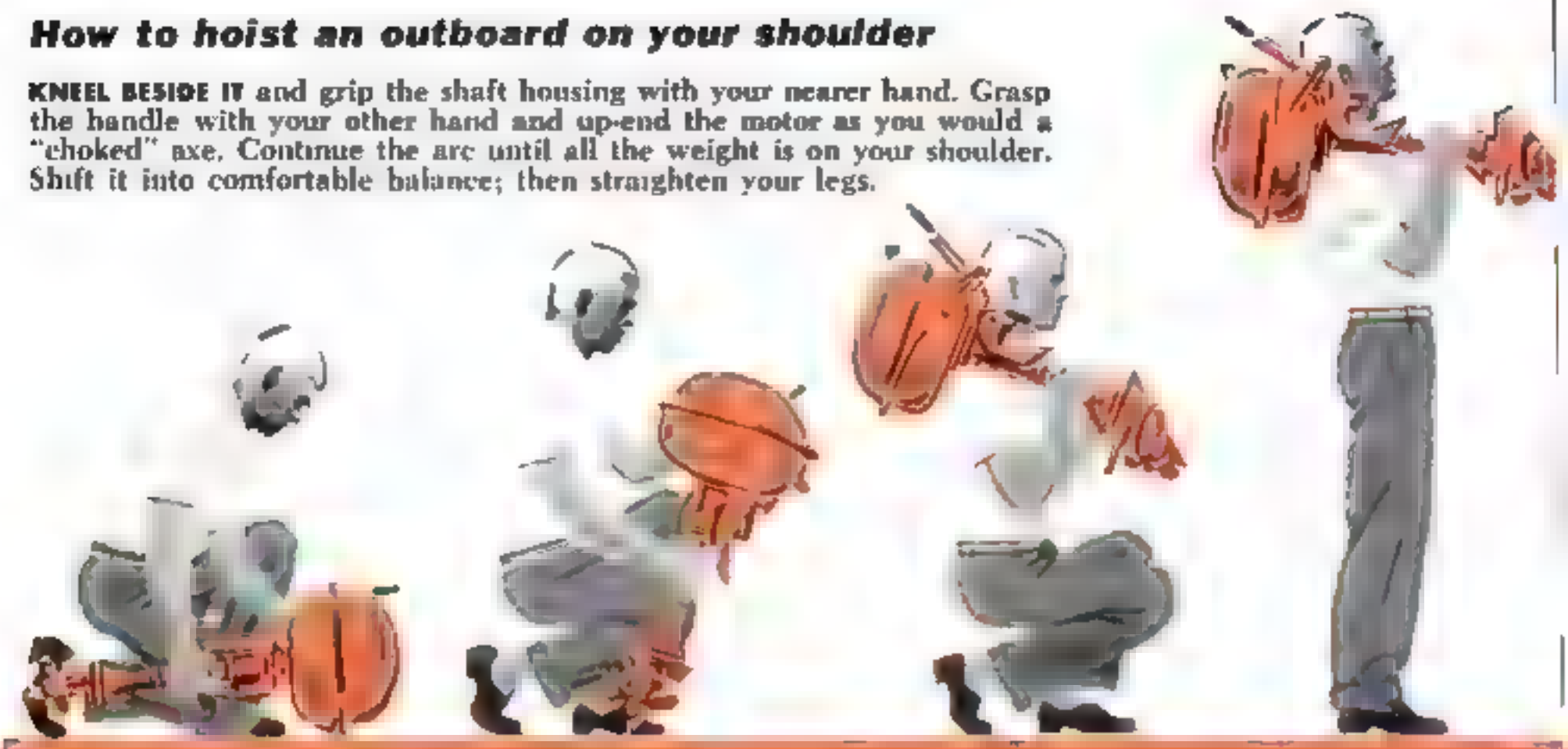
ANY way you look at it, a modern outboard motor becomes a mighty awkward hunk of machinery when you remove it from a boat transom. For a really big one, some sort of dolly becomes a must. But you still have a fair amount of hefting to do, and observing the old rules of weight lifting will save your muscles and safe-

TAKE A TIP from veteran guides, the easiest way to carry a motor on a long trek is slung over your shoulder. Use a boat cushion or life preserver as a pad when you portage a big and hefty one.

OUTBOARD CARRIER makes the chore a breeze where the going isn't rough. Tilt the frame back far enough to put some of the weight on your arms. Otherwise a sudden bump may pitch the motor forward.

How to hoist an outboard on your shoulder

KNEEL BESIDE IT and grip the shaft housing with your nearer hand. Grasp the handle with your other hand and up-end the motor as you would a "choked" axe. Continue the arc until all the weight is on your shoulder. Shift it into comfortable balance; then straighten your legs.



guard the motor. Equally important, don't try to take on a 200-pounds-plus baby without help. When one of these has to be carried over a rough trail or soft sand, clamp it to a two-by-four that's long enough to offer a convenient carrying handle on both sides. Then call on a partner to share the load with you

How to use teamwork. Getting a big-horsepower job from a dock to a transom —or the other way around—requires teamwork, too. Do the lifting or lowering with one of you on the dock, the other on the afterdeck. Where a winch isn't available, slip a line—an anchor rope is fine—through the motor handle. Then bring the two ends around the shaft housing just under the hood. Knot these snugly at the rear of the motor and let the dock man play out line or do the hoisting while the man in the boat guides the motor onto or off the transom.

The line serves another purpose, too: If the outboard gets away it's a simple matter to fish it out of the drink before any harm is done.

Another point almost too obvious to mention: If your outboard has an integral gas tank, don't fuel up until it's on the transom; it's easier to carry that extra 10 or more pounds as a separate load.

Finally, remember that while a dolly isn't necessary for a small motor, it still beats a strong right arm.

Do-it-yourself dolly. You can build one, with or without the help of a local welding shop, for $10 or less. With a pair of 1.75"-by-8" utility wheels equipped with semi-pneumatic tires, it will accommodate any motor up to 50 horsepower. If larger motors are to be carried, you'll need industrial wheels with a tire capacity of 200 pounds each.

The frame can be made in two ways. The construction drawing on page 189 illustrates the welded method, using 1" steel tubing. If you question the need for a weld at the handle center, it's done for convenience. By making the two 90-degree bends on separate lengths of tubing and then trimming the ends to get the exact handle width and length required, you save a lot of fussy curve plotting. A conduit bender also comes in handy here.

Alternately, you can sidestep welding and bending by using ½" steel pipe, 90-

4 Basic Rules for Motor Lifting

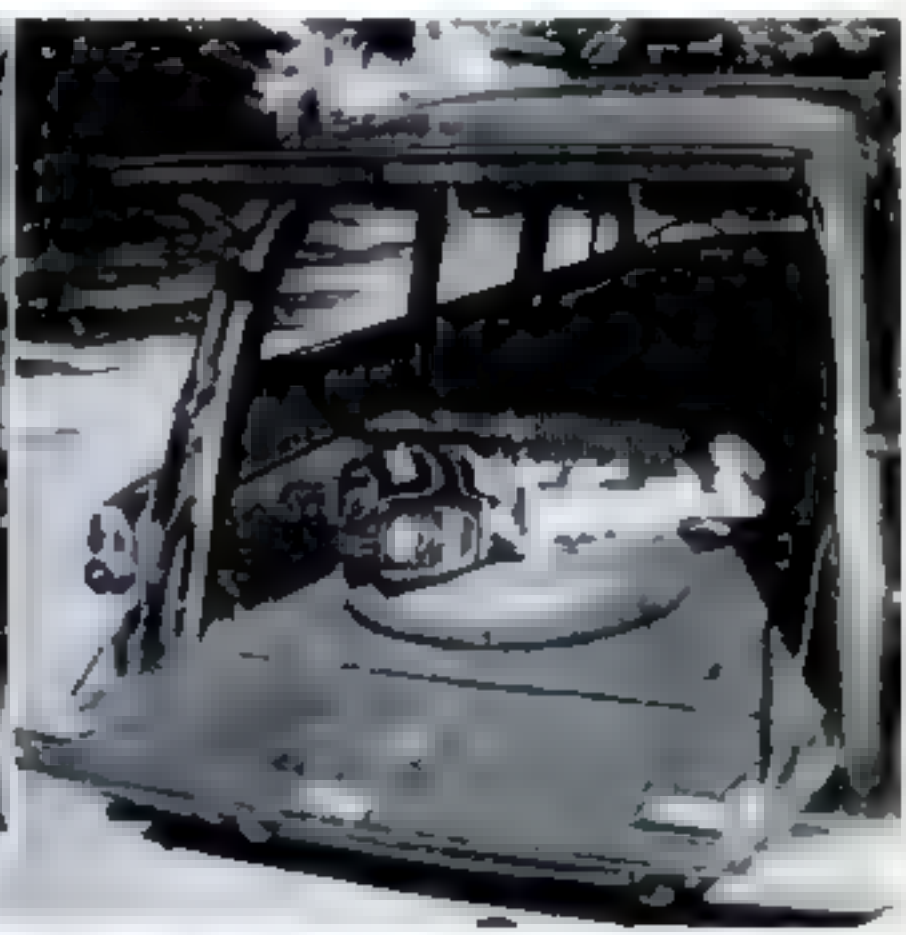
1. Bend your knees, but keep your back straight—it's built to take much greater loads that way.

2. Hold a motor as close to you as possible—otherwise you'll add the force of leverage to its weight.

3. Don't twist your body to swing a motor around. Instead, use footwork to turn it.

4. Be sure of your footing.

UPSTAIRS AND DOWNSTAIRS: In both cases, the right way is with the motor hood facing upstairs to keep from banging the underwater element against the stair risers. If it's a heavy motor, pick it up in your arms and hold it in close to you to avoid unnecessary leverage strain.



CAR LOADING: When you put a motor in a car or wagon, raise it to the trunk or tailgate edge and rest it there while you place one foot alongside. Then lift it the rest of the way up. Reverse the procedure when unloading, making sure the footing is firm behind you. Cradle a motor in an inner tube inflated to 10 pounds and it slides easily into a wagon. You'll save the outboard's muscles, too, during drives over backwoods roads. Place the motor with projecting controls facing up, to protect them and prevent puncturing the cushioning inner tube.

Off the transom it can be an awkward hunk of machinery

BOAT BOARDING: Don't step into a boat carrying any but the lightest motor. Leave a larger one on the dock until you're aboard. Then, facing the motor with your feet planted one in front of the other, lift it in, hood toward the stern.

TURNING: Aboard or ashore, never twist your body while lifting. Use footwork to turn a motor for transom mounting. At the same time hold the motor close to you. Watch where you're going; step *over*, not on, obstacles that may be in your way.

TRANSOM MOUNTING: With one foot well back of the other and in line with the motor, you're braced to support the outboard as you position it on the transom. Bend at the waist only enough to maintain your balance; lower slowly with your knees.

degree elbows, and a pair of tees for the joints connecting the uprights and axle sleeve.

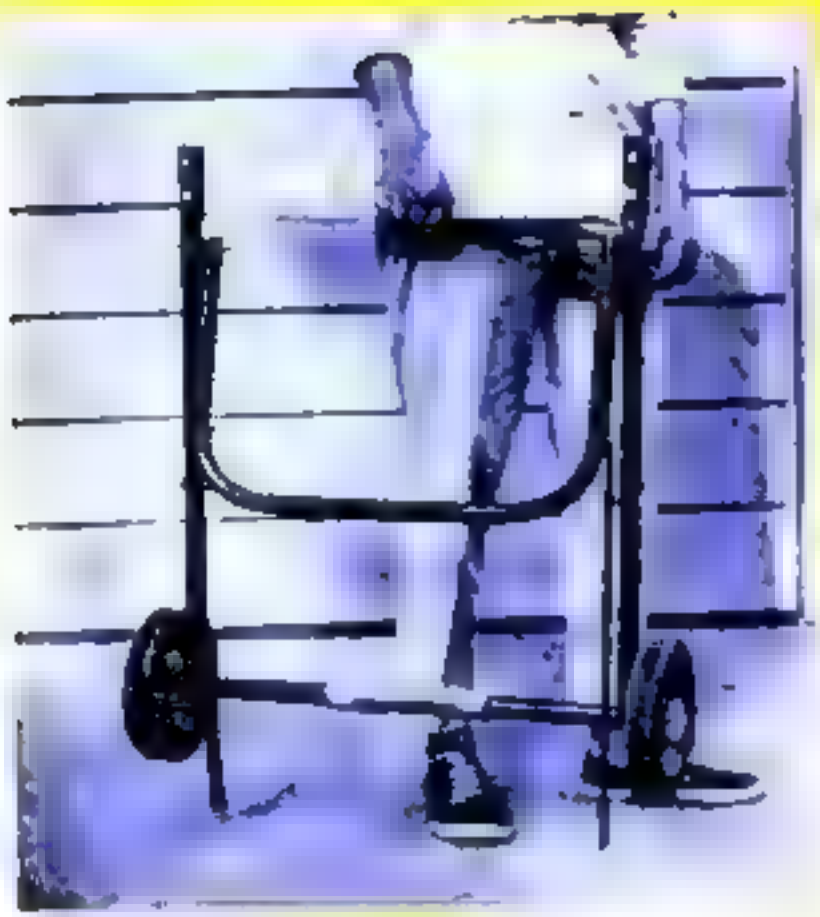
Either way, spot and drill the holes in the handle and other frame members to take the ¼" bolts that assemble the carrier.

With a welded frame, drill ½" holes through the lower ends of the uprights in line with the axle housing. Slip the axle through, place a spacing washer on either end to provide clearance between tires and frame, and then mount the wheels temporarily. This will let you spot index marks for two small cotter-pin holes. Withdraw the axle again, drill the holes and, if necessary, trim the axle ends to provide clearance for the hubcaps. Use the same procedure with a pipe-frame carrier, omitting only the drilling of axle holes—with tee couplings there's no need for them.

The mounting board. This is cut from a length of two-by-four that's free from knots. After drilling ¼" holes at each end, spaced to match those on the frame, fasten it in place with ¼" carriage bolts. These should be either cadmium- or zinc-plated.

Note that wing nuts are applied to the lower ends of the handle braces. With this arrangement, the bolts can be removed easily, the handle inverted and the diagonal braces swung forward and down, shortening and flattening the carriage for compact storing.

After coating the welds and braces with rust-preventive paint, enamel the completed assembly as desired.



CARRIER FOLDS for compact storage when bolts at the lower ends of the diagonal braces are withdrawn. The sleeve on the axle housing centers the wire basket.

ADDING BIKE BASKET lets you carry a remote fuel tank, starting battery, ice and stores. U-shaped brackets slip over the axle housing; rods inserted in handlebar clamps support rear of basket.

5/8"
1 1/2"
24" TWO-BY-FOUR
END FLATTENED
14"
1" TUBING
1" TUBING 28" LONG
9 3/4"
1/8" x 1" x 20" FLAT STEEL
1/4" x 1 1/2" MACHINE BOLT
WELD
2"
6" x 13" x 18" BICYCLE BASKET
DRILL FRAME TO TAKE 1/2" x 27 3/4" AXLE
1/2 RAD.
1 3/4" x 8" WHEEL
1/4" STEEL ROD
1 1/2"
1/4"
WELD
1 1/2" SPACER
26"
2"
BRACKET 1/8" x 1" FLAT STEEL
1"
BASKET HANGER

Short Cuts and Tips

FROM PS READERS

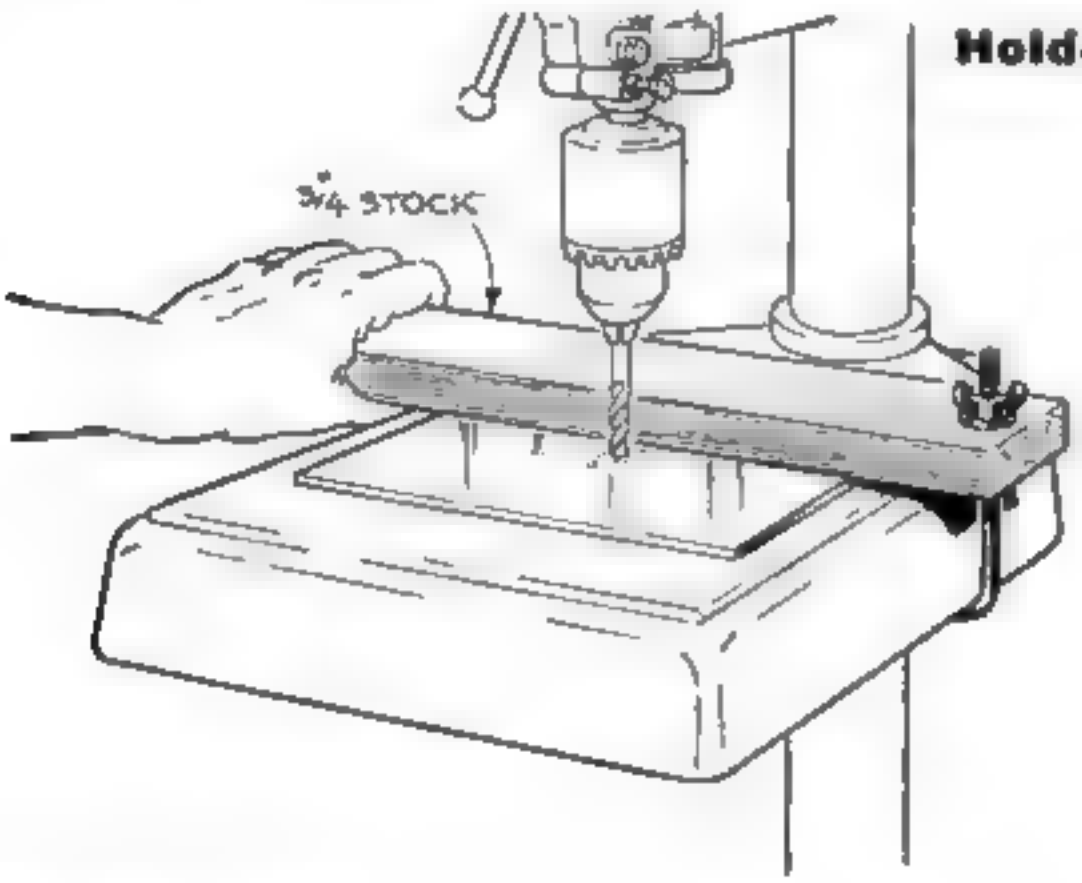
Friction-Tape Gaskets

EMERGENCY gaskets made from ordinary friction tape will substitute in a pinch for standard ones in pipe or tubing assemblies. You may find it handiest to tear the tape into narrow stripe and twist them into cords for installation in the joint. They will give long service on such jobs as reassembled sink drain pipes.—*Walter E. Burton, Akron, O.*

▶▶▶WHEN you carry pencils, screwdrivers, files and the like in your pockets, it is convenient to keep them in plastic toothbrush containers. Don't put more than one file in each container; the teeth may be damaged rubbing against each other.—*John Cullen, Springfield, Mass.*

Tip on Patching Cracks in Wall

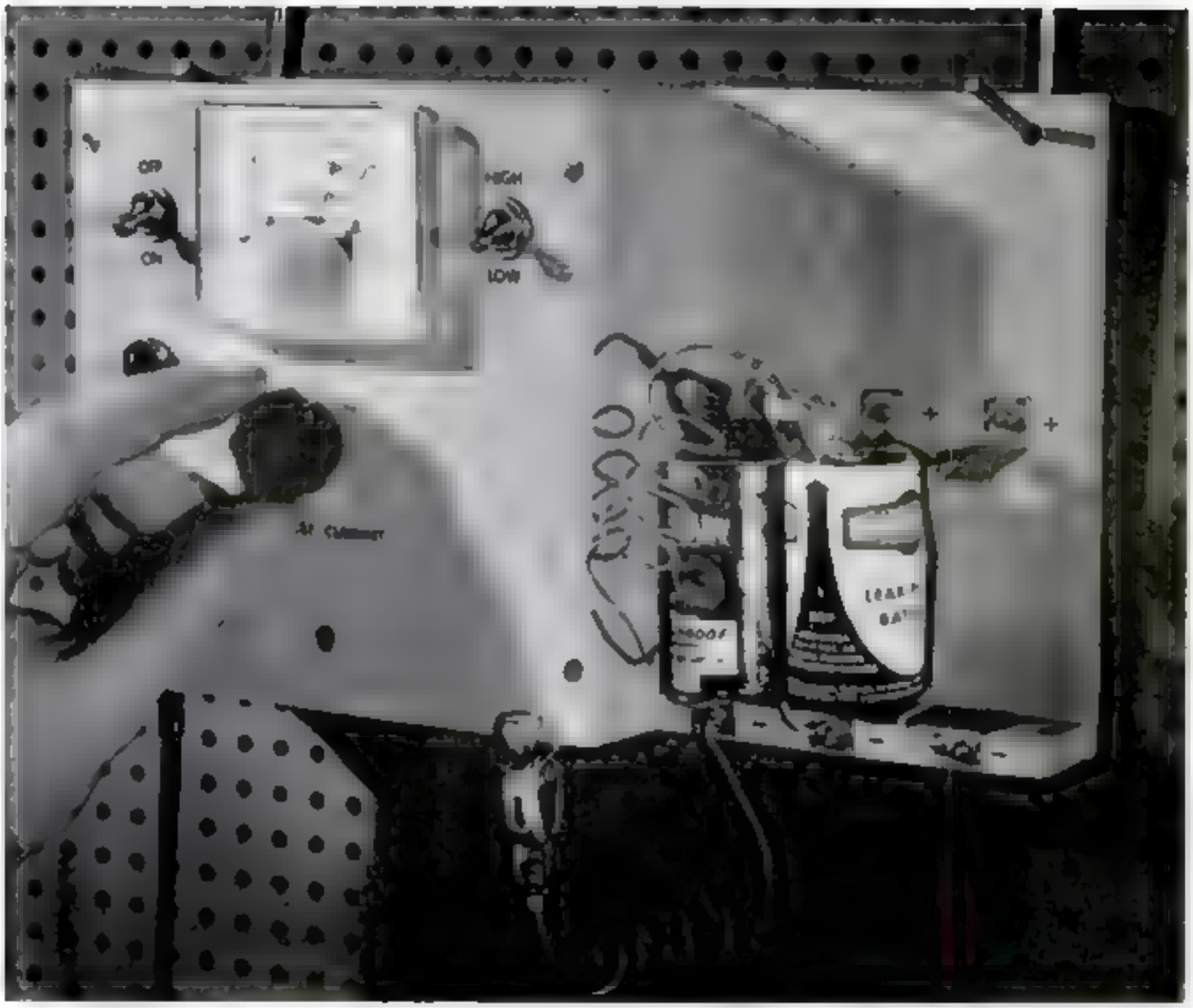
IF YOU put a bright light on the floor near where you are patching a plaster wall, it will cast shadows that will make cracks and holes stand out so they're easy to see. Place the lamp a little to the side of the spot where you are working.—*Henry R. Thompson, Boston.*



Hold-Down for Drill Press

YOU can hold small pieces of thin sheet metal on a drill-press table safely by using a simple clamp consisting of a handle cut from ¾" stock and a bolt with a washer and wing nut. Bend one end of the bolt so the head can be hooked around the lip beneath the table and provide a firm grip.

Fabric belting tacked or cemented to the clamp's underside will prevent marring the work when pressure is applied to keep it from turning.—*Max R. Best, Detroit.*



An easily made battery rejuvenator gives you a profitable bonus:

Extra Life for Your Dry Cells

By Howard G. McEntee

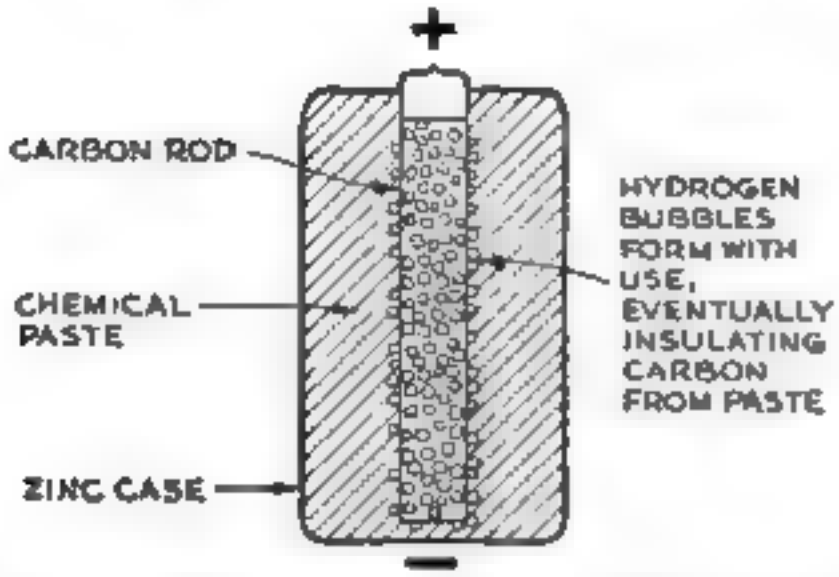
DOUBLING the life of the dry cells in use around your home is the next best thing to buying 'em wholesale. It halves the cost.

The battery rejuvenator shown has proven itself under test. It will *more* than double the life of a standard carbon-zinc cell. Tally up the number of cells that power your children's toys (many take four) and various household gadgets, and you'll find replacement costs add up fast when you shell out 20 cents apiece.

The instrument resembles a battery charger, and its operation is similar—it forces moderate current into the cell. But dry cells cannot be recharged in the same manner as your car's battery.

How a dry cell is rejuvenated is the subject of some debate, but the basic idea is that forcing moderate current backwards through the cell tends to remove accumulated hydrogen from the carbon pole, and alters the chemicals in the cell to restore their activity. Most

An overnight trickle of house current makes tired



THERE'S PLENTY OF LIFE in many a dead dry cell, but hydrogen bubbles that form on the carbon pole insulate it from the still-active paste. Rejuvenating removes the unwanted bubbles.

important is the removal of hydrogen bubbles that tend to insulate the carbon from the chemical paste, eventually depolarizing the cell.

The materials you need to build the rejuvenator cost about $8, but operating cost is negligible since it draws less current than the smallest night light.

The chassis can be built from small pieces of ¼" plywood, with the electrical parts mounted on a 6½"-square panel

To keep down the cost of parts, two inexpensive 6.3-volt filament transformers are used, but if you happen to have a couple of six-volt bell transformers in your junk box, they'll do as well. Connect their primaries in parallel to the 115-volt AC line and run the secondaries in series through a high-low switch (SW2). This will permit you to use a single transformer for one, two or three cells; or cut in both transformers to double the output for rejuvenating four or more cells, or a single six-volt bell or lantern battery.

When wiring in the transformers, watch for one pitfall: It's possible to hook them up incorrectly so that you'll get zero voltage from them. The best way is to connect the primaries and the secondary of T1, temporarily leaving the secondary leads of T2 long. Connect a DC voltmeter across the output, set the high-low switch at low and turn on the juice. You should get a reading of six volts. Flip the switch to high and look for a 12-volt reading. If the reading drops near zero, reverse the secondary leads from T2. Other connections to the variable resistance, switches and meter are clearly shown in the pictorial diagram; just hook up the wires as shown.

The cell mounting clips can be strips of brass, as used here. If you're the lazy type, you can buy commercial battery holders in model-plane shops and radio-supply stores. Permanently connect the clips with jumper wires from positive to negative to put them in series. Connect the negative wire from the rectifier to the first negative battery holder and run from it a 15" extension wire fitted with an alligator clip. The positive wire running from the meter is 18" long and is fitted with an alligator clip. This is hooked onto the positive holder above the last battery in any group being rejuvenated to complete the series circuit.

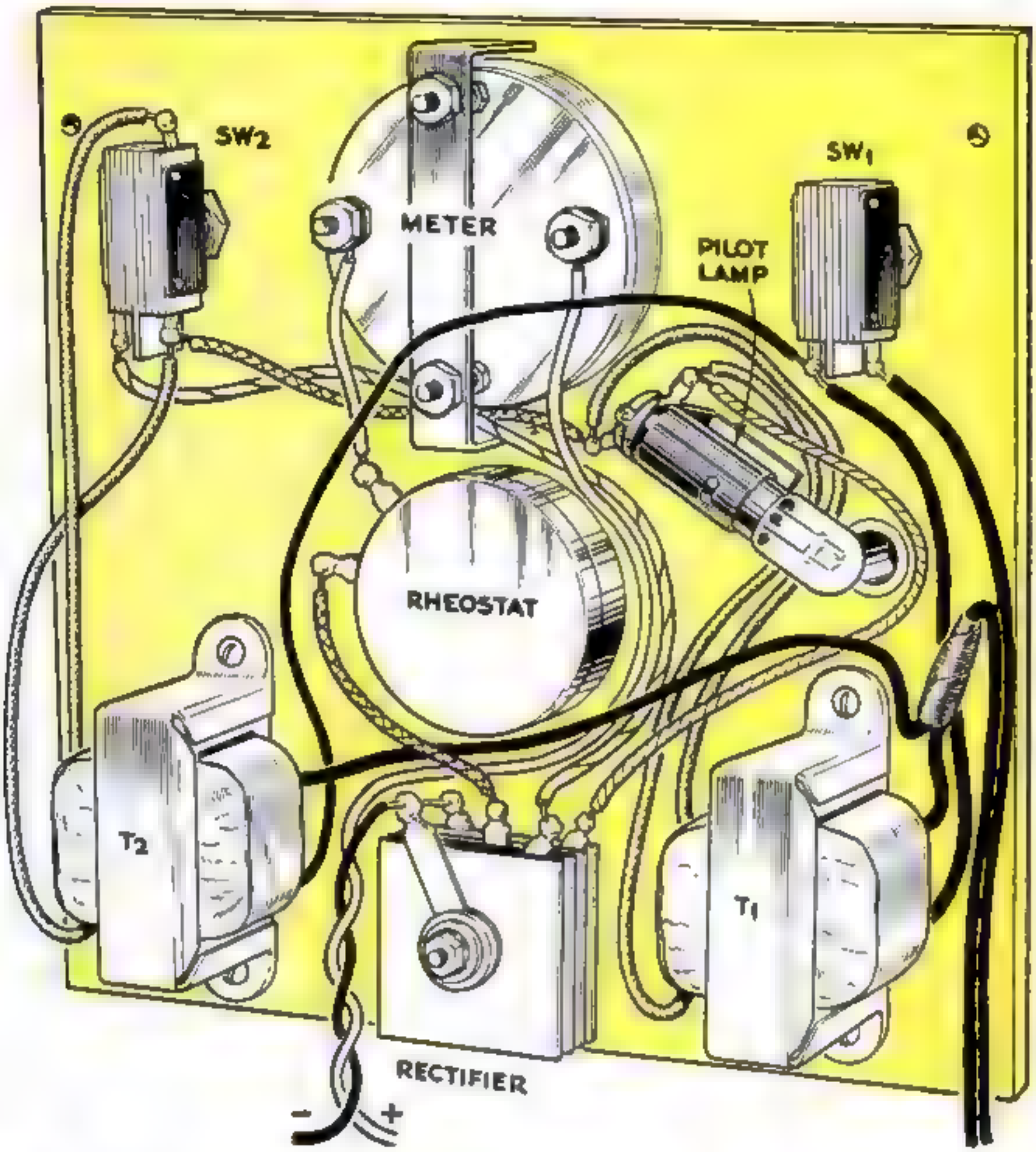
Using the rejuvenator is largely a matter of feel and instinct. Generally the slower you "cook" the cells the better, but they can be given a fast boost if you check them every hour or so. If they become warm to the touch, reduce the current—overheating tends to evaporate the precious moisture within the cells, rendering them completely useless. When cooking three cells or less, begin with a setting of about 100 to 130 milliamperes on the meter with the range switch set at low. Four or more cells—or a six-volt lantern battery—require about the same meter setting, but flip the switch to high. Cooking time should be 12 to 16 hours in most cases.

Batteries will last longer and perk up faster if you give them an occasional

CAUTION!

DON'T try to rejuvenate any of the new alkaline or mercury cells. Unless you *know* your cells are the standard carbon-zinc type (the others cost much more and are labeled "energizer" cells) better not try to boost them. If you guess wrong, you could have a potent and messy explosion. The new cells don't need charging. They last up to 10 times longer than ordinary cells.

dry cells fresh and ready for use by morning

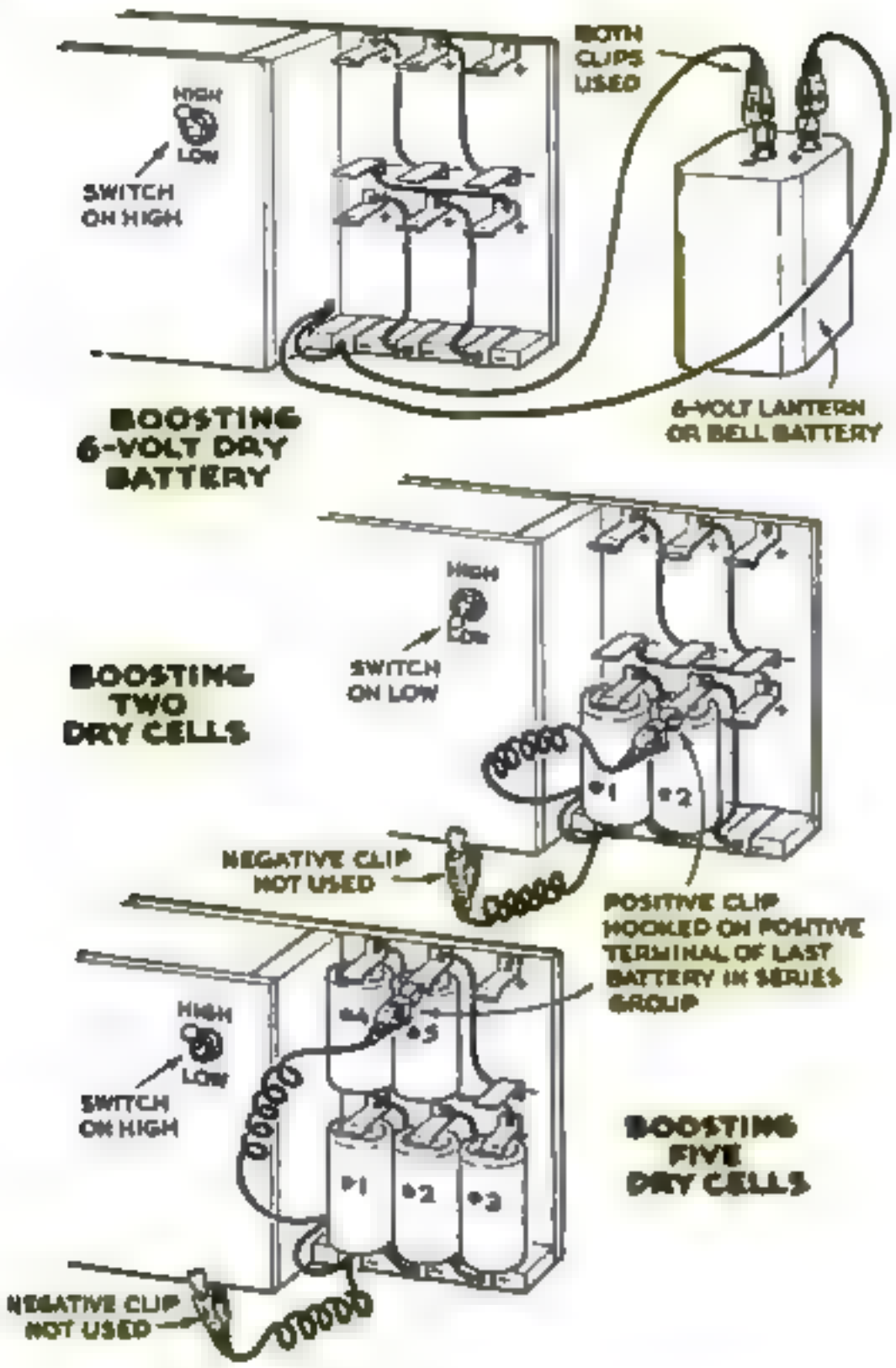


PICTORIAL ARRANGEMENT of parts—easier to savvy than a schematic—shows how wires are connected. Light wire in twisted pair at right extends 18", is fitted with an alligator clip. Dark wire runs to first negative battery holder, then to a 15" extension as shown on the following page.

THE PARTS YOU'LL NEED

Symbol	Item	Type	App. Cost
T1, T2	6.3-volt filament transformers	Lafayette #TR-11	$2.20
Rect.	Low-voltage bridge rectifier	Int Rect Corp. #B1B	1.50
M	150-ma. meter, square plastic case	Shurite #8308	2.00
R	100-ohm wire-wound rheostat	Mallory #M100RK	.80
SW1	On-off switch, SPST toggle	any	.50
SW2	High-low switch, SPDT toggle	any	.60
PL	Pilot lamp and socket	any #47	.30
	Knob for R, battery clips, line cord, panel decals		.40
		Total cost	$8.30

How to connect the batteries



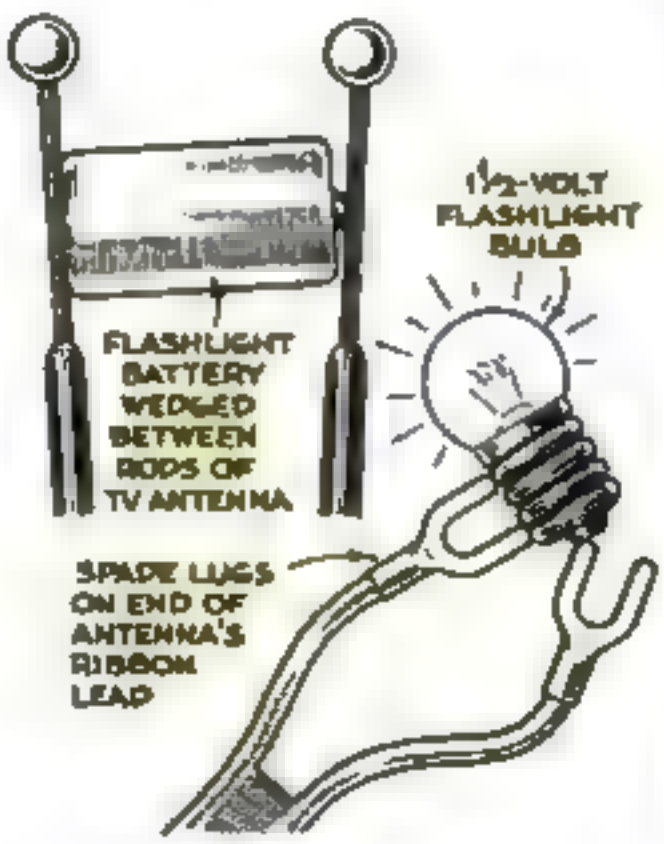
boost *before* they are run down completely. This can be done repeatedly, although in time the active material inside them will be used up, making further rejuvenation impossible. A small voltmeter with a built-in resistance—the type photographers use to check photoflash cells—will serve as a guide to battery condition.

In a flashlight, cells let you know they're weak by producing a dim light, but cells used in radios, toys and other equipment carry on to the point of exhaustion, and should be tested occasionally. A reading of 0.9 indicates a completely dead 1½-volt cell that may or may not respond to rejuvenation.

SIX-VOLT LANTERN BATTERY can be rejuvenated by hooking the two extension clips to its terminals (top drawing). Note series wiring of dry-cell holders. In center, two cells are being treated. Positive clip is hooked to No. 2 cell holder; negative clip is not used. By shifting the positive clip to the last holder in use (bottom), up to six cells can be boosted. END

Simple Continuity Test Checks Indoor TV Antenna

If you suspect a bad antenna connection or a break in the ribbon lead, hold or tape a dry cell in contact with the antenna rods and touch the lead ends to a flashlight bulb as shown. The bulb will light if all is okay. If it flickers instead, there's a broken wire or loose connection. If it doesn't light at all, try replacing the lead.—*Art Trauffer, Council Bluffs, Iowa*



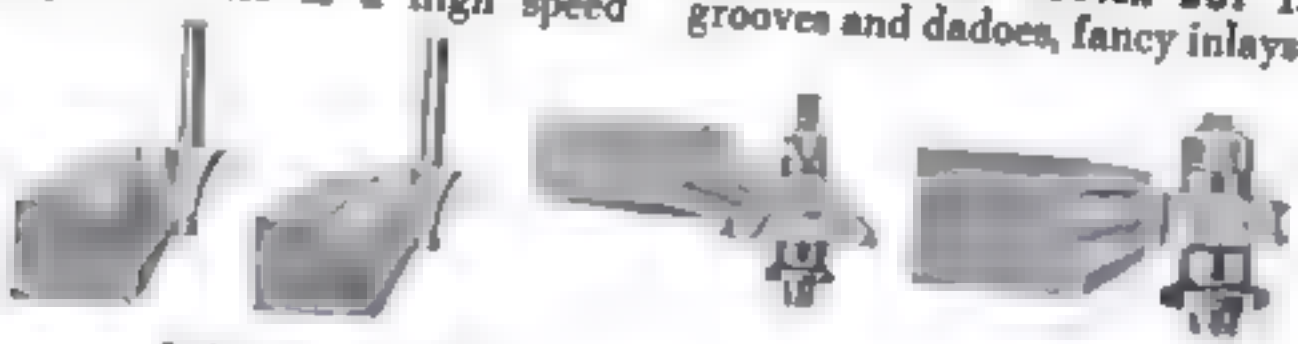
POWER TOOL MAGIC

THE ROUTER—*Miracle Woodworking Tool*

In many ways, the portable router can transform almost any hobbyist into a skilled woodworking artisan. Many of its operations were once confined to stationary equipment in furniture and millworking plants. But the professionals there quickly adopted the router, and now even the home craftsman, with a little practice, can turn out comparable professional work with ease and dispatch.

Basically, a router is a high speed motor with chuck to accommodate specially shaped bits and cutters. There are over 200 of these bits and cutters in the Porter-Cable line. The router motor may be removed from its base and used as a power source for a high speed plane and a stationary shaper. Both of these attachments are economical in cost since the one motor powers all these tools.

WHAT DOES THE ROUTER DO? It cuts grooves and dadoes, fancy inlays; puts



Typical bits and cutters used with the router. (Left to right) Roman ogee bit, beading bit, cove and bead cutter, surface bead cutter.

gracefully curved edges on ornamental molding, makes professional wood joints like the dovetail and tongue and groove. Hours of tedious, repetitious operations in fine cabinetmaking, are automatically eliminated.

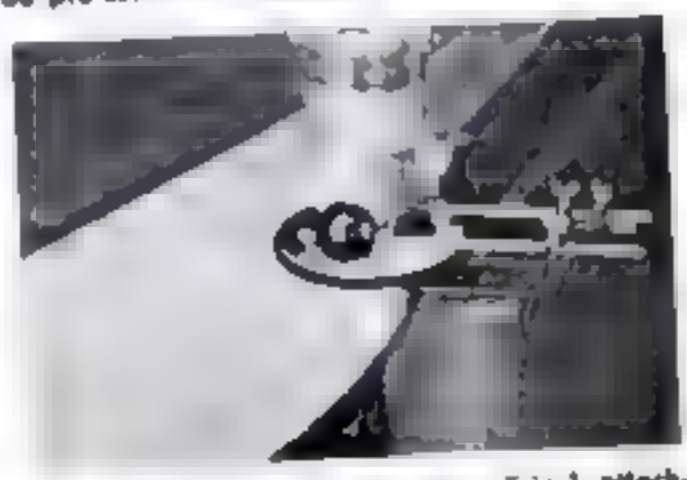
The Porter-Cable router is extremely versatile. Accurate, too. The depth of cut can be controlled to within 1/64". With its motor turning at better than 20,000 rpm, it operates with phenomenal smoothness even on plywood. The whole machine weighs only about 5½ lbs., so control is easy.

PRACTICE IS THE KEY, HOWEVER. This is particularly true since you'll use the router on work where mistakes can't be patched without showing. Experts often use templets and patterns. Many of these devices are readily made with your router itself, and once made, are used over and over. Where operations are repetitious, they save time; where critical, they save tempers.

STANDARD ATTACHMENTS ARE A BIG HELP. One is the Porter-Cable Magic Guide. This handy yet inexpensive accessory is actually five router guides in one. With it you can make perfect circle cuts, radius cuts, ornamental designs, accurately spaced slots and grooves and hundreds of other professional cuts. It even acts as an edge plane! Another attachment is the shaper table. It converts your Porter-Cable router into a stationary tool, holding the router in an inverted position. The

Used for circle cutting, the 5-in-1 Magic Guide cuts inside circles and produces ornamental work.

When producing shelving, the 5-in-1 Guide can be pre-set with accurately spaced slots.

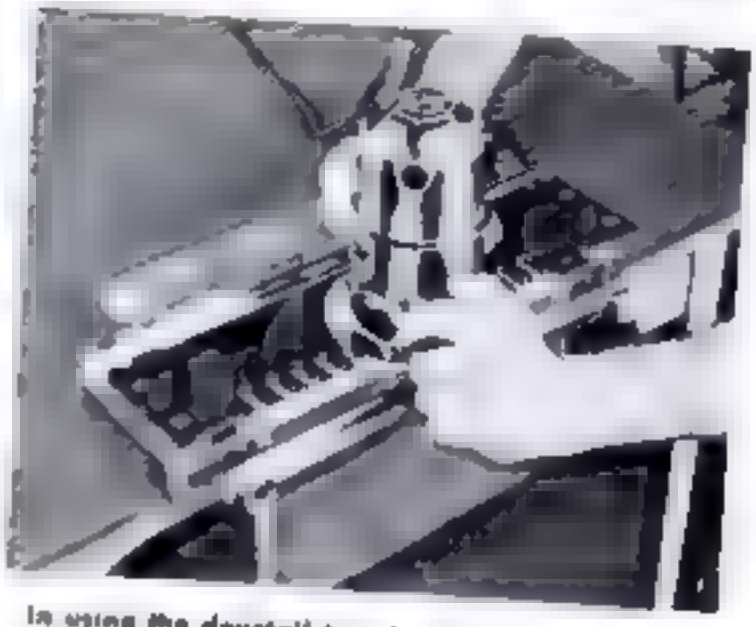


For inlay work on curved pieces, 5-in-1 attachment acts as a radius guide. A simple adjustment converts it to a straight edge guide.

Magic Guide has adjustable shoes and micro-set adjustment for precision edge planing.

A rabbet or step cut being made with the shaper table. Router motors and cutters may be adjusted for varying depths of cut and hundreds of shapes.

cutter, therefore, remains in full view. The shaper table eliminates many freehand operations, and is useful on such pieces as long, narrow moldings, since the work constantly is aligned. With the plane attachment, your Porter-Cable router becomes a power plane at very minor cost. Besides speed, you get a smoother, more precise cut than with hand planing. The router is constructed so that its power unit can be quickly installed on such accessories as the shaper table and plane attachment, and just as easily re-converted to its original purpose.



In using the dovetail templet, a perfect joint can be made in 12 seconds.

An example of the templets you can obtain for your Porter-Cable router is the dovetail templet. It is invaluable for making clean, close-fitting dovetail joints in record time. Once adjusted, it provides assembly-line speed, eliminating guesswork and time-consuming measurement.

This 14" plane attachment features a long shoe base, patented chip disposal, fingertip depth adjustment up to 3 32" deep, bevel adjustment to 45°. High-speed router motor produces a glass-smooth edge even on glue-bonded plywood.

This Porter-Cable 1/7 h.p. router is economical yet offers the same precision features incorporated in larger models. Model 162

$49.95

THE PORTABLE POWER SAW . . .

Magic Time and Money Saver!

Porter-Cable Model 66 **$39.95**

If you do any volume of woodworking, a circular power saw will save time and labor worth a dozen times the cost. With today's modern materials a portable power saw offers the only quick, safe and handy way to cut panels of plywood, hard board, and other large pieces to size with any accuracy. It is also the answer to ripping and cross cutting long boards and heavy lumber. The Porter-Cable Model 66, with a budget price tag, has many of the features found in far more expensive saws. It makes a full cut through 2" dressed lumber, including compound miter cuts. The famous Porter-Cable KickProof clutch protects you and the work if the saw jams. The telescoping blade guard is another safety advantage —only the teeth that are actually cutting are exposed when the saw is in operation, and the specially-designed lip on its leading edge prevents jamming when the saw enters the stock. Self-lubricating bearings on jackshaft and armature provide long service life. Instant depth and calibrated bevel adjustments give you complete accuracy with every type of cut. The 66 is a welcome addition to any workshop.

Canadian prices slightly higher for tools shown on this and other pages.

Powerful Model 66 has 8 amp power for all homecraft cutting.

Model 66 bevel cuts 2" dressed lumber from 0° to 45°.

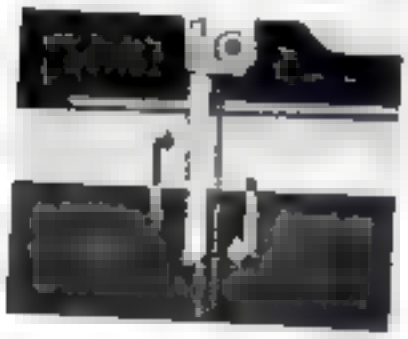
Pocket cuts are quick and easy with this handy saw, too.

Look what you can do with the ELECTRIC HAND SAW

Angle cuts—equipped with the angle base, quickly and easily cuts accurate angles up to 45°.

Scrollwork—makes easy work of intricate cuts—with professional results every time.

Metal cutting—sheet metal, pipe, bar stock, rods are quickly and accurately cut.



Fastest cutting saw on the market—improved orbital action does it. Cuts smoother, blades last longer.

Model 152 Hand Saw..... **$54.95**

The Porter-Cable 152 Electric Hand Saw can be one of the most essential tools in a home workshop. It's actually seven saws in one—a rip saw, crosscut saw, coping saw, keyhole saw, scroll saw, jig saw and hack saw. It cuts, rips, crosscuts and miters 2" dressed lumber, cuts steel, brass, aluminum, sheet metal, pipes, plywood, plastics, masonite and countless other materials. Best of all is the accuracy of the cut on all of these operations, since the Porter-Cable 152 saw has both a top handle and auxiliary side handle for awkward positions and intricate cuts. The king-size base gives stability on every cut and the sawdust blower keeps the cutting line clearly visible. When cutting plastic or wood laminates, the patented insert disc holds the work close against the blade and prevents shredding or chipping. Available in handy 10 piece wall kit 152K..... $59.95.

These Leading PORTER-CABLE DEALERS will help you

ALABAMA

BIRMINGHAM Birmingham Saw Works
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PINE BLUFF Fox Brothers Hardware

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AUBURN Alpha Hardware Co.
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Ford Hardware
Pioneer Mercanti e Co
BERKELEY Card's Dwight Way Hardware Co.
COSTA MESA Karm Rima's Hdwe
COVINA Bu lders Emporium
ESCONDIDO Churchi l & Cassou Hdwe
FORT BRAGG Lirleys Build ng Sup.
FORTUNA Fortuna Hardware
HAYWARD Shagga Hardware Supermarts
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SAN JOSE Emery s Power Tool Mart
SAN LORENZO Village Building Sup.
SAN PABLO San Pablo Hardware
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Lehr Electric Motors
SANTA ROSA Dixon Hardware Co.
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COLORADO SPRINGS Bishop-Hill Tool & Paint Co.
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BRIDGEPORT Hawley Hardware
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MERIDEN Colony Hdwe Co.
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NEW HAVEN H & B Sosensky
Woodcraft Supply Co
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RIDGEFIELD D. F. Badient Co.
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Fox Cycle & Hdwe Co.
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TORRINGTON Union Glass Co.
WALLINGFORD Colony Lumber Co
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DELAWARE

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DISTRICT OF COLUMBIA

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[illegible] Brooker Lumber Co. Inc
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Southside Hardware Co.
LAKE WALES Townsend Sash Door Lumber
LAKE WORTH Leverenz Hardware Co.
MIAMI Alvin Builders Supply Co.
Bailey's Lumber Yards, Inc
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Renuart Lumber Yards, Inc.
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ST PETERSBURG Gulf Beach Paint Hardware
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SARASOTA Orange State Lumber Co.
Sarasota Hardware & Paint Co
Shepard Lumber Company
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ATLANTA Everys Hardware
Williams Bros Lumber Co

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Model 165 Belt Sander
$49.95

How to get professional finishes — FAST

This compact belt sander is the answer for fast stock removal and for fine even finishes on large surfaces. It will outperform ten men working at hand sanding—and do a better job. The Porter-Cable Model 165 weighs only 7½ lbs., evenly balanced to give positive control with less fatigue. Use it vertically, horizontally, or overhead. It takes standard 2½", 2¼", or 2" belts, and you can change belts in seconds. An improved tracking mechanism keeps the belt perfectly aligned, and a patented device keeps them at proper tension. Other high-quality construction features include a powerful 5½-amp. motor, precision spur gears, specially-lubricated ball and sleeve bearings, and neoprene-covered drive pulley.

Light weight makes the 165 belt sander easy to use for such jobs as smoothing wallboard joints, ceilings, etc.

A real time-saver for stock removal fine cabinetwork, paint and varnish removal.

Belt changes are quick and easy Abrasive belts come in fine, medium and coarse grits for every sanding job.

These Leading PORTER-CABLE DEALERS will help you

[illegible]
Maplecrest Hardware Co., Inc
NEWARK Market Hardware Co
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POINT PLEASANT BEACH
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CARLSBAD The Big Jo Lumber Co.

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HORNELL Hollands Lumber Company
HUDSON
Hudson Lumber & Supply Corp.
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Snow Electric Company
KENMORE Kenmore Renting Co
KINGSTON Shults Paint Company
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NEW ROCHELLE
Charles Librett Hardware
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ABC Tool Rental & Sales Co
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OLEAN West State Hardware
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C. Mikielio Floor Coverings Co.
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Wayne Coal & Lumber Company
PORT WASHINGTON Alper's Hardware
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J. E. Andrews Hardware Co. Inc
ROCHESTER Arrow Materials Corp.
Atlantic Millwork Company
Clark's Hardware
Country Gentleman Store
Lester Hardware
Ridge Lumber Company
H. C. Schoenheit
G. G. Schwarz Company
SALAMANCA Dietrich Hardware
SAUGERTIES P. C. Smith & Son
SCHENECTADY Capitol Paint Stores
David Mahoney Co., Inc.
Mayfair Handy Hardware
SENECA FALLS Scofield Hardware
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COLUMBUS Cohagan Hardware
Columbus Hardware Supplies, Inc.
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MANTUA Mantua Lumber Co., Inc.
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OREGON

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EUGENE
Scharpf's Twin Oaks Builders Sup. Co.
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ALIQUIPPA Specht Hardware
ALLENTOWN Allen Hardware, Inc
AMBLER G. M. Deck & Sons
ARDMORE Smith Supply
BANGOR Bangor Hardware & Paint
[illegible] Schaeffer Hardware
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Greenwood Lumber Co., Inc
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Southport Lumber Co.
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MARION Byrd Lumber Co
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IOWA

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MASON CITY Curries Hardware
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MAINE

BIDDEFORD McKenney & Heard
PORTLAND The Harris Company
Maine Hardware
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MARYLAND

ABERDEEN Livezey Lumber Company
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ARNOLD Amplex of Md., Inc.
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The Hardware Fair
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CATONSVILLE John S. Wilson Co.
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The Wilson Hardware Co.
DAMASCUS Boyer & Cramer
ESSEX Albert Milke & Sons, Inc
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Kauffman Manufacturing & Supply Co.
KENSINGTON McIntire Hardware
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TOWSON Stebbins-Anderson
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Ford Lumber Co. Inc

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CHICOPEE Lysek's
HAVERHILL
Haverhill Hardware & Plumbing Supply Company
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Spence Hardware Supply Company
NEW BEDFORD McGee's
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Quinn's Wallpaper & Paint Inc
PITTSFIELD Carr Hardware Co
Pittsfield Supply Co
SOUTH HADLEY FALLS
Street Supply Corp.
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Hancock Hardware & Supply Co.
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C. C Adams Hardware Corp
Edwards Paint & Wallpaper Corp

MICHIGAN

ADRIAN Smith Hardware & Toys
BIRMINGHAM A. L. Damman Co
DEARBORN Chase Road Hardware
Hardware Depot
DETROIT Beatty Electric Tool
Bullock-Green Hardware Co
Cadillac Tool & Hardware
A. L. Damman Co
Dewey's Lumberville
Fromm's Hardware
Gamalski Hardware
GRAYTON PLAINS Keego Hdwe. Co
EAST DETROIT A. L. Damman Co
FARMINGTON
Robertson Hardware Co
FERNDALE Keen Edge Saw Works
GALESBURG
Martin Motor & Machine Supply
LINCOLN PARK The Renner Co., Inc
LIVONIA Cadillac Tool & Hardware
MANISTIQUE C-L Hardware
MT CLEMENS A. L. Damman Co.
OWOSSO
Himburg's Hardware & Plumbing
PONTIAC McNabb Saw Service
WYANDOTTE Jagers Hardware

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AUSTIN Cleveland Hardware Co
FARIBAULT
Minnesota Maintenance Co.
HUTCHINSON C. H. Stocking
[illegible]
G. C. Peterson Machinery Co.
H. E Swanson Co.
Thompson Lumber Company
Warner Hardware Co
MOORHEAD Red River Hardware Co
ROCHESTER
Brumm Builders Hdwe., Inc.

MISSISSIPPI

JACKSON Addkinson Hardware Co.

MISSOURI

HANNIBAL Mark Twain Supply Co.
JEFFERSON CITY
Strong Bros. Millworks Lumber Co.
KANSAS CITY Bunting Hardware Co.
MONETT Wilks Lumber Co.
ST LOUIS
Hathaway Paint & Hardware Co Inc
Lang Saw & Equipment Co
The Geo F Smith Company
SPRINGFIELD
Springfield Mill & Lumber Co.
WEBSTER GROVES Ace Supply Co

MONTANA

ANACONDA Marchion Hardware Co.
BILLINGS Stroup Hdwe Co.
[illegible]
W J. Sewell Hardware Company
KALISPELL Ostroot's Sharp Shop
LIVINGSTON Builders Machinery Co.
MISSOULA Kramis Hdwe Co.
THOMPSON FALLS Pyatt Lumber Co.

NEBRASKA

GRAND ISLAND
Grand Island Hardware
LINCOLN Lawlor's

NEW HAMPSHIRE

LACONIA Laconia Electric Co

NEW JERSEY

BELVIDERE L. E. Ritter Lumber Co.
CAMDEN Highway Distributors Inc
Power Tool & Equipment Co.
ELIZABETH
S. Strassman Hardware & Paint Co
FLEMINGTON Flemington Lumber Co.
GARFIELD
Complete Saw Service of N J.
S. Meltzer & Sons Inc.
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These Leading PORTER-CABLE DEALERS will help you

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LATROBE Latrobe Hardware
McKEESPORT Ungar's Hardware
MEADVILLE Wolff's Hardware
MENDENHALL
Mendenhall Lumber Company
OXFORD George Fredd & Son
PHILADELPHIA
Alco Lumber & Supply Co.
Carpenters Machinery Company
F. E. Reber Supply
Tool & Equipment Corporation
Weber Hardware
PITTSBURGH Fort Pitt Hardware Co.
Gil-Con Tool Co.
PORT TREVORTON
G. Flanders Keller Enterprises
READING Merritt Lumber Yards, Inc.
SCHUYLKILL HAVEN
Haven Hardware Co.
SCHWERKSVILLE
Schmoyer's Lumber Co.
SMETHPORT
J. Alfred Johnson Hardware
TITUSVILLE
Reliable Builders Supply Co.
WEST CHESTER
M. S. Yearsley & Sons
WILLIAMSPORT
Hermance Machine Co.
WYALUSING
Glenn W. Arey Lumber Company

RHODE ISLAND

WEST WARWICK
Majestic Hardware Company, Inc.

SOUTH CAROLINA

BEAUFORT Fordham Hardware Co.
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RAPID CITY Westside Hardware

TENNESSEE

KNOXVILLE
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Newton Rental Tools & Hardware
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HOUSTON Buffalo Hardware Co., Ltd.
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Stettner Hardware
Wessendorff, Helms & Co.
LAMESA Forrest Lumber Co.
MARSHALL Logan & Whaley
NACOGDOCHES Cason, Monk & Co.
ODESSA Lyna Lumber Co., Inc.
SAN ANTONIO
Brannen's Tools & Machinery
Joske's of Texas

UTAH

OGDEN Kammeyer's Sport Store
SALT LAKE CITY
Electric Motor & Supply Company

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BRANDON
Brandon Lumber & Millwork Co.
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VIRGINIA

ALEXANDRIA Bellview Hardware
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Martin's Hardware
ANANDALE Star Supply Co., Inc.
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The Star Supply Co., Inc.
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FAIRFAX Fairfax Hdwe & Supply Co.
MANASSAS Manassas Lumber Corp.
RICHMOND
A. L. Lorraine Hardware Co., Inc.
Puckett Hardware
Guy Smith Hardware
ROSSLYN Virginia Hardware
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TACOMA Tucker & Sons
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BROOKFIELD Ralph T. Nitz Hdwe.
FOND DU LAC Wisconsin Lumber Co.
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MILWAUKEE
Midwest Saw & Knife Company
National Supply & Hardware Co.
MONROE Fred Lanz Hardware Co.
SPARTA Sparta Lumber & Fuel Co.

WYOMING

CASPER Casper Lumber, Inc.
COODY V Lumber Co.

CANADA

(Canadian Prices Slightly Higher)

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Disher Equipment (Alberta) Ltd.
EDMONTON
Disher Equipment (Alberta) Ltd.

BRITISH COLUMBIA

KIMBERLEY
Lloyd's Hardware Ltd.
[illegible]
Disher Equipment Ltd.
VICTORIA
Moore Whittington Lumber Co. Ltd.

MANITOBA

WINNIPEG
Luke's Electric Motors & Machinery
Co. Ltd.

ONTARIO

[illegible]
Sherman's Merchandise Sales Co.
FORT WILLIAM
G. P. McEachern Ltd.
HAMILTON
The Garvin Hardware Co. Ltd
Tools & Equipt. Co. (Hamilton) Ltd.
KENORA Williams Hardware Co. Ltd.
MIDLAND F. W. Jeffery & Sons Ltd.
[illegible]
Allied Building Supply (Ottawa) Ltd.
W. A. Rankin Ltd.
ST. THOMAS Hawke Hardware Ltd.
TORONTO Aikenhead Hardware Ltd.
L. S. Tarshis & Sons

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MONTREAL
The J. Pascal Hardware Co. Ltd.
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J. S. Mitchell & Co. Ltd.

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HONOLULU City Mill Co.

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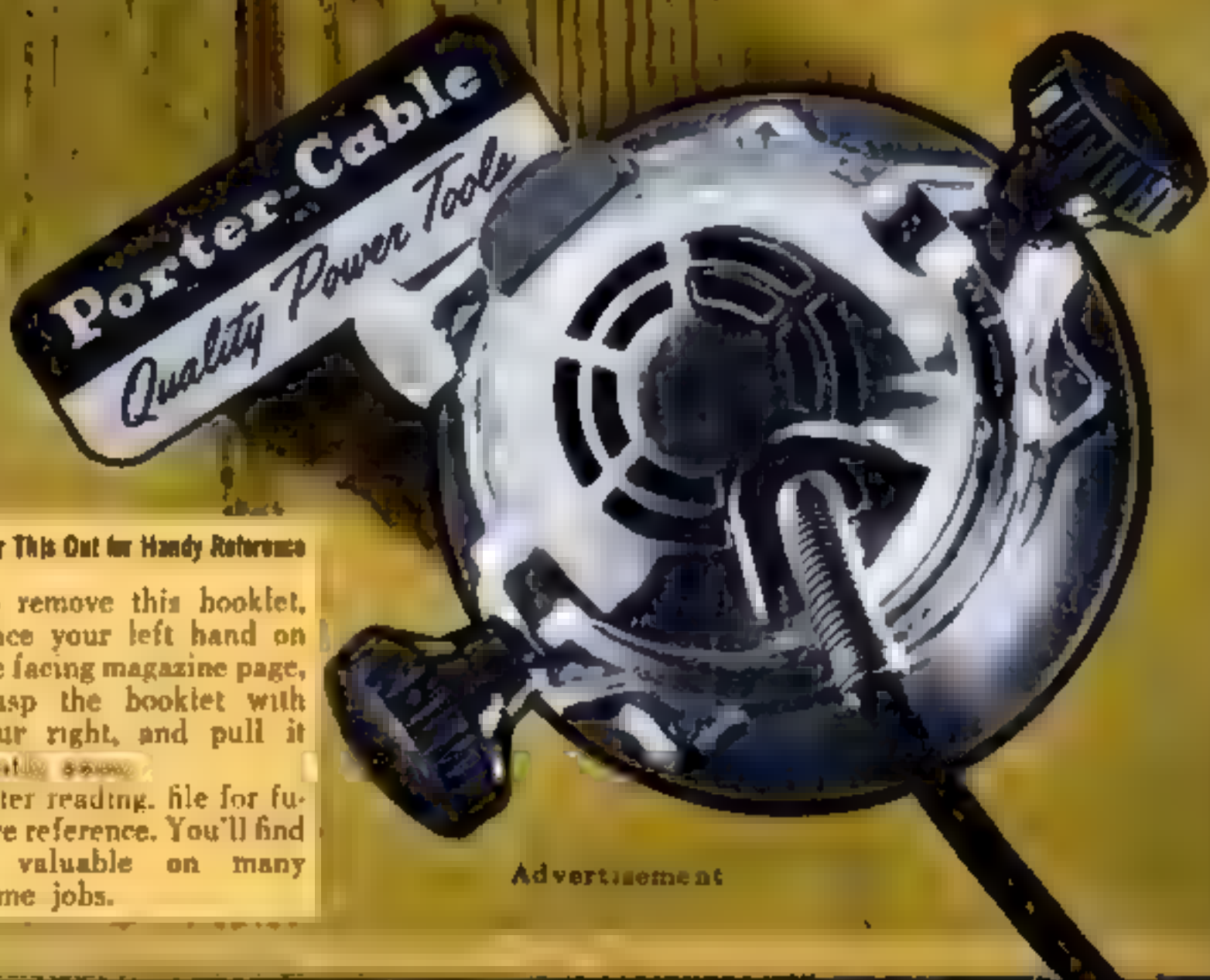
C.I.A. General Distribuidora, S.A., Ave.
San Antonio Abad 236, Mexico City, D.F.

POWER TOOL MAGIC



Tear This Out for Handy Reference

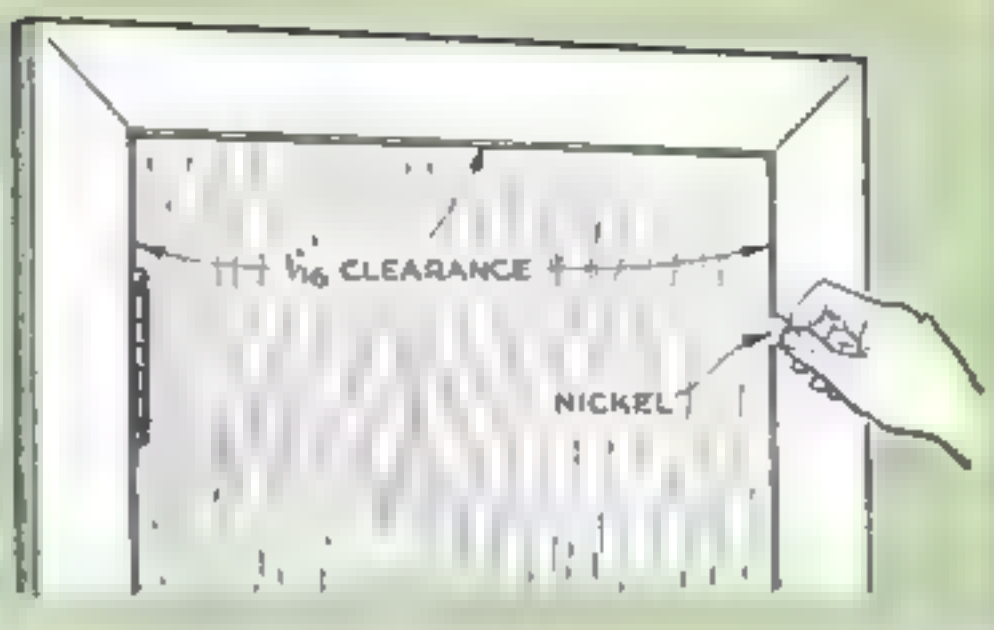
To remove this booklet, place your left hand on the facing magazine page, grasp the booklet with your right, and pull it gently down.

After reading, file for future reference. You'll find it valuable on many home jobs.

Advertisement

Door Repairs 2

NICKEL IS HANDY GAUGE for checking door clearances. A properly fitted door should have a nickel-thickness (1/16") of space between door edge and jamb at sides and top. Bottom clearance may be more, depending on whether the door swings out over carpeting. If it's still bulky after you've checked its alignment (see Door Repairs I, Mar. PS), you'll have to plane it to fit.



How to plane a door

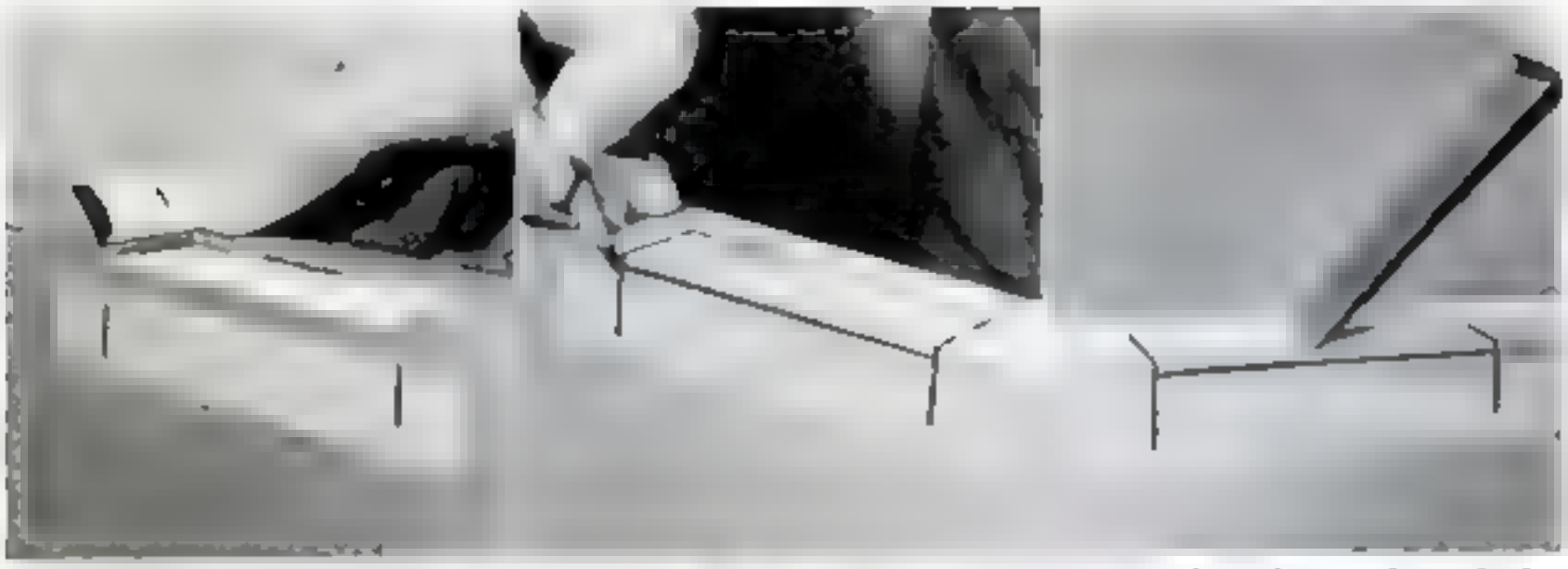
TO HOLD THE DOOR ON EDGE while you work, clamp a wood box to each end at opposite sides. Protect the finish with small blocks of wood between clamp and door. Slit a piece of inner tube and snap it over the door knobs to keep the latch from gouging the floor (center). Lightly chamfer the corners to keep wood from splintering while you plane. Cut down the high spots first, then run the plane along the entire edge to smooth it. Caution: Check the edge frequently with a try square so you don't bevel it.

Deepen hinge gains after light planing

AFTER SHAVING DOWN THE HINGE SIDE, you'll find the gains are no longer deep enough to set the hinges flush. Deepen the outline by tapping the chisel straight down.

BREAK UP THE SURFACE of the recess with a series of chopping cuts. Then chisel away the wood until the hinge is once again flush with the door edge and screw it into place.

How to locate new hinge gains

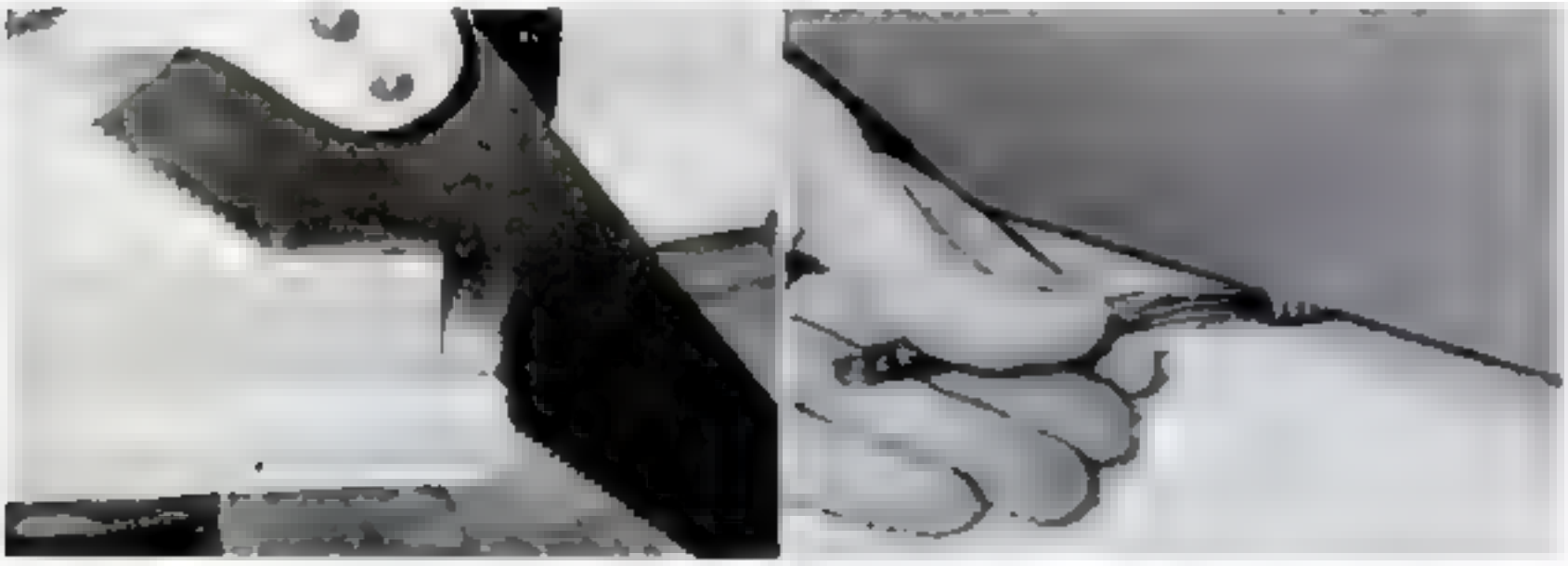


HEAVY PLANING may completely remove the hinge gains. Stick tape on the face of the door and mark the position of the gain, and note its width. After planing, extend the marks on the tape to the edge and mark the width for a new cutting outline (center). Make a series of chopping cuts and chisel out to the thickness of the hinge.

How to shift the lock

IF PLANING ON THE LOCK SIDE is necessary to keep a panel pattern centered, remove door knobs, side plates and screws holding lock face. Loosen lock by prying through knob hole with a thin screwdriver (left), then hook a nail in the screw holes (center) and pull it out. After planing, deepen the mortise enough to reset the lock face flush, and elongate knob and key holes. Plug old screw holes if side plate won't cover them.

Trimming the bottom of a door



SAWING IS THE EASIEST WAY, probably, if much material must be removed from the bottom edge, as when new carpeting is installed. Clamp a strip of plywood under cutting line on door and saw through both.

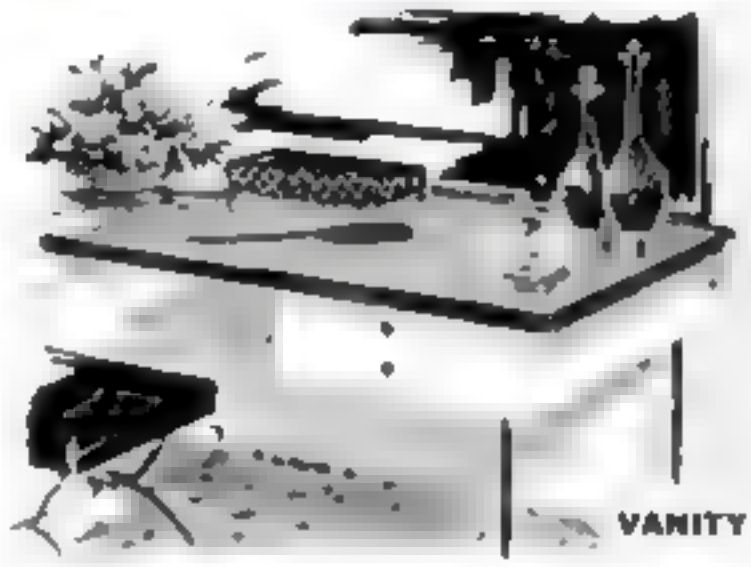
RESEAL RAW EDGES WITH PAINT after planing or cutting. Top and sides are easy to reach with a paintbrush, but if you've already hung door to check fit, use an old toothbrush to spread paint over the bottom edge.

materials file

Background information on

Counter Coverings for the Home

KITCHEN COUNTER



VANITY

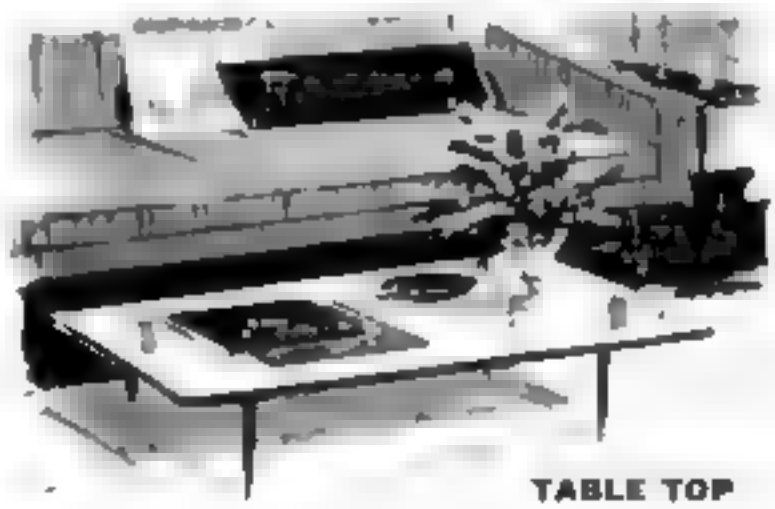


TABLE TOP

BASEMENT BAR

CHOOSING a counter top is fun these days—yes, even fun for men—because there are so many different types to choose from. Perhaps you've wanted an eye-catching bar, a topping for a coffee table, a surface for the desk in the den. Your wife wants a chopping block, a pastry counter, a bathroom vanity.

Today, counters aren't just for kitchens—they're all over the house. You aren't restricted to just one or two materials. Wood, plastics, linoleum, ceramic tile, even marble and stainless steel, are all in the running—and at prices that aren't beyond the imagination or the pocketbook

To get a counter that's just right for your particular needs, judge it by these points:

- Will it clean with a wipe?
- Is it stainproof and rotproof?
- Will it be used as a chopping block?
- Can hot pots or cigarettes mar it?
- Will it keep new-looking?
- Most important, does it have the qualities needed for the area in which it will be used?

Plastic laminates (such as Formica and kindred products) are the most popular counter surfacings. Laminate means made up of layers, like a sandwich, and that's exactly what these plastics are. Layers of paper are soaked in tough resins, molded together under high pressure and baked. The top layer of paper has the color or design you see in the finished product. In

some cases, instead of paper, real wood sliced 1/64" thin is used.

You'll find two kinds of laminates. The so-called high-pressure type, made with melamine, is rigid and is sold in sheets, usually $\frac{1}{16}$" thick. Low-pressure laminates, made with polyester resins instead of melamine, are not as durable as the high-pressure type, but cost about one-third less.

You can tell the two apart because the low-pressure ones are $\frac{1}{32}$" thick—half as thick as the high-pressure type—and are usually flexible enough to be sold in rolls. One advantage of their thinness is that joints are less conspicuous if you plan to edge your counter with the same material as the top.

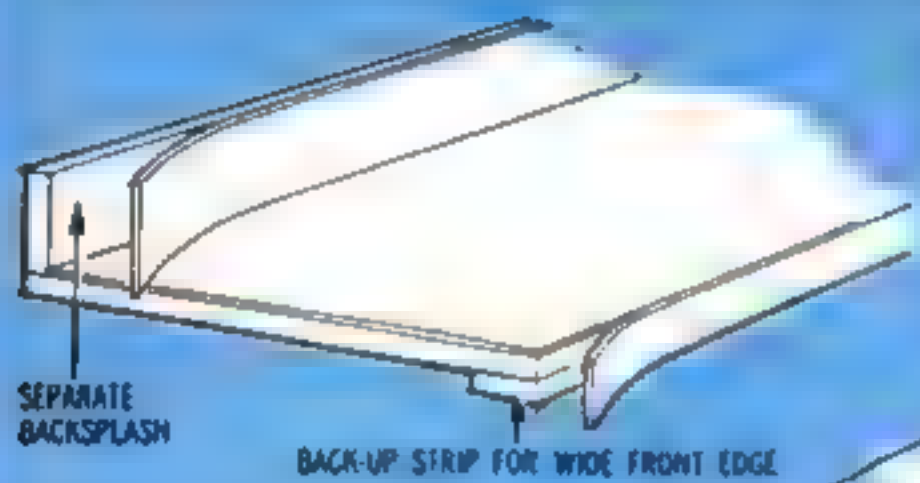
Pros and cons. Plastic laminates wipe clean. They won't fade, spot or rot, and under normal use they should last 20 years or more. They take temperatures up to 275 degrees, so they are unharmed by boiling water, but you can't set a hot pot or skillet on them. The plastic will bubble up and be ruined. You can't use it as a chopping block either—it scratches. A tip: Plain colors, especially white, are more likely to show scratches and knife cuts than patterns. Wood-grain and marble patterns, on the other hand, may be troublesome to match at joints.

Plastic laminates can be edged with strips of the same material or with snap-on chrome or stainless-steel moldings. Self-edging saves the cost of metal trim, gives a handsome modern look, but takes more time and skill to install. The joint at a counter's backsplash can be butted, but a metal cove makes a tighter fit.

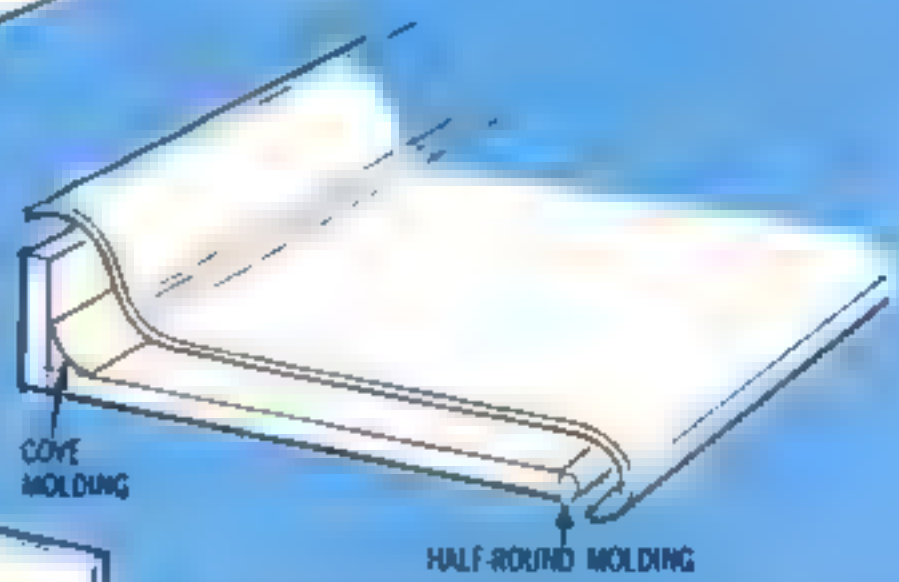
If you're careful and painstaking, you can do your own installation. Manufacturers supply complete instructions. New water-soluble contact-bond adhesives eliminate any danger of flammable and toxic fumes. If you wish, you can buy the laminates prebonded to ¾" plywood.

Plastic laminates are also available as

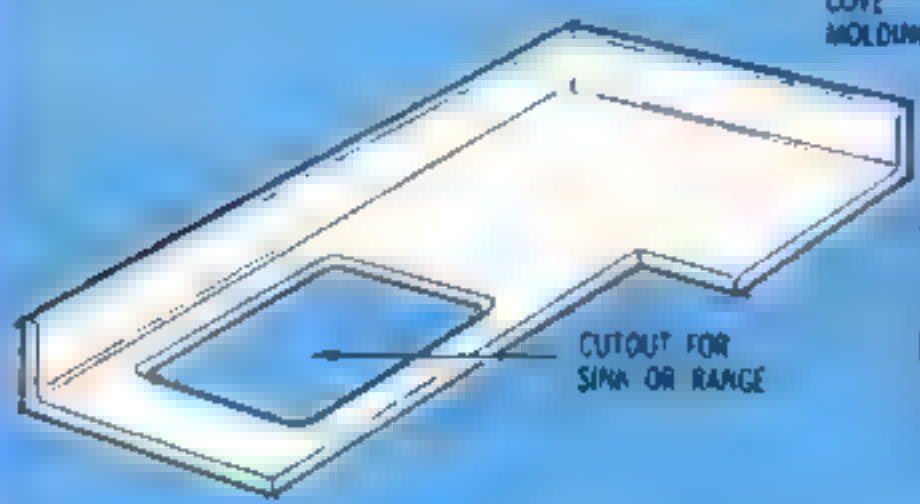
Three Ways to Buy and Use Popular Materials



RIGID SHEETS, called plastic laminates, must be applied as separate flat strips. Edges can be faced with the same material as the top or with quick snap-on metal trim.



FLEXIBLE VINYL PLASTIC (at right) is less durable than laminates, but can be curved in one piece to make a rounded front edge and a seamless cove joint at backsplash. Linoleum can be shaped in the same way.



PREFORMED COUNTERS come ready to install in straight and corner sections of varying lengths and with or without cutouts for sinks or cooking burners. The plastic type is seamless and has rounded edges; similar prefab stainless-steel sections are square-edged. Matching hardwood chopping blocks are also available to fit between sections.

complete, ready-to-install counter tops. The plastic is coved up at the blacksplash and rounded down over the front edge to produce a completely seamless one-piece top. Often the front edge is raised slightly to keep anything spilled from running onto the floor.

Lacking seams, prefab counters are easy to swish clean, but they have some disadvantages. Sometimes it's difficult to make a machine-perfect counter fit into corners that aren't absolutely square and against walls where studs are somewhat in and out. Backsplash height is usually limited to 4" or 4½", while in on-the-job fitting you can run the backsplash up as high as you want.

Sheet vinyl is a newer material than the plastic laminates and costs only about half as much. It's flexible, comes in large rolls, and so can be run across the counter and up a wall in one piece. Backed by half-round molding, it can be bent around the counter's front edge.

Vinyls are more resilient than the laminates and quiet dish clatter better. Some manufacturers offer vinyls in patterns to match flooring. This is an advantage in a small room, for it will make it seem larger. The one drawback to vinyl as a kitchen-counter material is its poor resistance to heat. Hot pans stick to it and melt it. Cigarettes burn it. Even boiling water damages it.

Linoleum's big advantage until recently has been low cost, but now this is almost matched by the newer, low-priced vinyl coverings. Still, it has several good points. Like vinyl, linoleum is strong, quiet and not easily dented. Unlike vinyl, it does not melt under heat, although it can be scratched and scarred by very hot pans and cigarettes. Knife cuts and scratches also show up somewhat less than on vinyl.

Linoleum's main disadvantage is that it stains easily and absorbs water, which causes it to rot around a sink. With

How Counter Coverings Compare

MATERIAL	COMMON SIZES	ADVANTAGES	DISADVANTAGES
PLASTIC LAMINATES	Rigid sheets 1/16" thick up to 4'-by-8' or larger	Won't stain, rot or fade, keeps new-looking indefinitely	Hot skillets, toasters, electric percolators, etc. may damage it. Knives will cut it
SHEET VINYL	In rolls 30" to 72" wide	Flexibility makes it easy to bend and produce seamless finish. Quiet, resilient, inexpensive	Low resistance to heat. Hot pans melt it. May stain slightly from some foods and medicines
LINOLEUM	In rolls 1/16" thick, 72" wide	Low price; won't melt under heat; makes good surface for writing	Cuts easily, rots, fades, scratches, stains, mildews
STAINLESS STEEL	16 or 18 gauge	Extremely durable, sanitary, easy to clean. Resiliency minimizes breakage of dishes	Shows soil readily, lacks color. Not good for cutting and chopping—it dulls the knives. Will scratch
CERAMIC TILE	Many shapes from ½" to 12" squares and oblongs. Most common are 1" and 4¼" square tiles	Very durable. Immune to heat and staining. Fireproof	Noisy and unresilient. Glassware and dishes break easily
MARBLE	¾" thick for self-supporting counters; ½"-thick tiles for use on base. Use only grades A and B	Beautiful, natural material. Superior for rolling out pastry or for hot pots. Needs no backup or moldings	Stains, scratches, is unresilient
WOOD	1½"-thick laminated maple or birch	Best surface for cutting and chopping	Stains easily. Difficult to clean and maintain

waxing and care, it may last 10 years or more, but usually requires replacement sooner. Linoleum is excellent, however, for retopping an old desk, table, workbench or drawing board where spilled liquids are not a problem.

Stainless steel's new popularity for counters stems from its good qualities as a kitchen sink. It's the most durable and the easiest to maintain of all counter materials. Nothing found around the house, including photographic chemicals, will stain it. That many health department codes require it in restaurants and public places is testimony to its sanitary excellence.

Most prejudice against stainless steel dates back to the use of Monel metal and German silver. Stainless steel won't spot like Monel. It doesn't have the copper content. Nor will it dent like German silver. Its surprising resilience is what makes it so kind to fine china and glassware. Anyone who still complains of stainless steel spotting and fingermarking hasn't discovered the trick of occasionally wiping it with lemon oil.

Factories prefab stainless-steel counters with sink, no-drip edge and backsplash all stamped out of one seamless piece. You can also get counters custom-made with the sink of your choice and stove burners flush-mounted anywhere you wish.

One problem with a stainless steel counter is to get a tight joint between the backsplash and the wall. In new construction, the best way is to flash the backsplash right into the wall, then bring the wall surfacing down over the flashing. Plastic laminates make an attractive wall surfacing for use with stainless steel for they can supply color and pattern.

Ceramic tile is greaseproof and stainproof. Hot pans can't hurt it; neither can spilled bleaches or nail polish. Sunlight won't fade it, and water can't penetrate it. Now a new waterproof grout also makes the joints between the tiles impervious to grease and staining.

The biggest drawback of tile is its lack of resilience. Glassware and dishes break easily, and pots clatter on its hard surface.

Either glazed or unglazed tiles make a satisfactory counter. Choose the glazed finish for an easy wipe-clean surface. New, tougher glazes have recently been developed that are practically immune to scratching. You'll find them offered under such names as "Everglaze," "Duraglaze," and "Crystalline glaze." Bathroom counters are not likely to be subject to much abuse, and ordinary glaze is acceptable there.

The natural beauty of marble is hard to beat, although it comes at a premium price and does have some drawbacks. Use it in the bathroom for a luxurious touch. In the kitchen, a section of marble counter provides an unexcelled surface on which to roll out dough or set hot pans.

Marble needs no backing or edging. A separate piece is used when a backsplash is required. The most practical marble thickness for home use is ⅞", but up to 2" is commonly available. Use only grade A or B. Others are not sound enough and may crack. A special wax, available from marble dealers, helps protect marble from staining. Even so, it will stain only if spills are allowed to stand for some time.

Sinks installed in a marble counter are attached from underneath. The joint between sink and counter should be made with plaster, never putty. The oil in putty will stain the marble

Recently introduced marble tiles, ½" thick, make it possible to use marble at about half the former cost. The tiles are set like ceramic ones over a wood base.

Wood is kind to knives and makes the best counter for cutting and chopping. Having a section made of it is more convenient than having to pull out a board. Wood counters, 1½" thick and made of laminated maple or birch, cost about the same as plastic-laminate counters. A section 15" to 18" wide is usually sufficient for most cutting purposes.

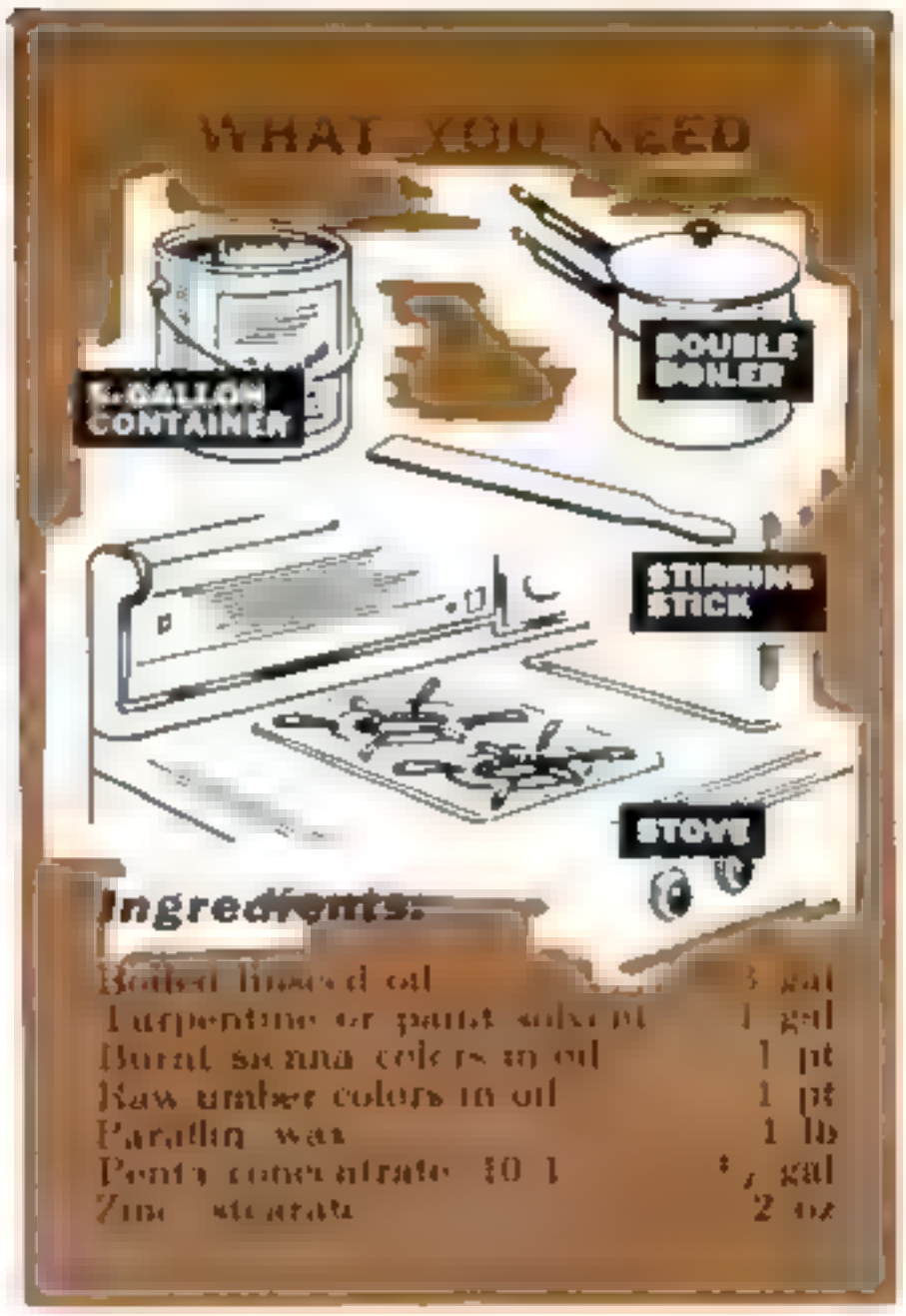
The best finish for cutting boards is a rub-down with hot mineral oil to seal out moisture and stains. If the counter is used for serving, or as a bar, then choose a clear, high-quality varnish or plastic-resin finish for a hard, impervious surface.

A combination of materials often provides the best kitchen counter. Use tile, marble, or stainless steel where hot pans and skillets are to be set. Use laminated wood in food-preparation areas, marble or wood in baking centers. Use a plastic laminate or a sheet vinyl for colorful and easy-to-maintain surfaces elsewhere.

know-how file

How to mix

A Natural Finish for Wood Siding



YOU can make your own natural finish for wood siding—one that recent scientific tests have proved more durable than any other formulation. The apparatus you need to mix it is all easy to come by, and the ingredients—there are seven of them—are stocked by most paint stores. Finally, there's the formula—developed, tested and recommended by the U. S. Forest Products Laboratory, in Madison, Wis.

You may eventually be able to buy the finish under a manufacturer's label. But in the meantime, here's what you'll get if you mix your own:

- A protective covering that combines the durability of dull wood stains with the rich sheen of varnish-like finishes (but its sheen will last from three to four times as long).
- One-coat coverage on new wood, good for four or more years under normal weathering conditions.
- Renewal coats that can be brushed right over old ones of the same type, eliminating the troublesome scraping and sanding that must usually be done to prepare old surfaces for a good bond.

Two points of caution, though. When you apply this finish over older types that leave a glossy surface coating, these must be removed first. And if you ever decide to paint over surfaces that have previously been treated with the new finish, you must be sure that no traces of wax remain on the wood.

The accompanying red-cedar formula yields five gallons of the new finish—enough to cover an average three-room ranch-style house.

For effects other than red cedar, you can vary the amounts of colors-in-oil. To get a light redwood shade, use half a pint of burnt sienna and two-thirds of a pint of raw umber; for dark redwood, half a pint each of burnt sienna and raw umber, and one pint of pure red iron oxide (Indian red). You can also prepare lesser amounts of the finish by simply reducing the ingredients proportionally. To estimate how much you'll need, figure on one gallon for every 400 to 450 square feet of smoothly planed wood, or one gallon for every 200 to 250 square feet of rough-surfaced wood.

Use care in mixing the ingredients. First pour the turpentine or solvent into a large container. In another room, melt the paraffin, mixed with the zinc stearate, in the upper half of the double boiler, keeping the flame that heats the water in the lower section low. When the mixture is uniform, pour it into the turpentine or solvent, stirring vigorously. Avoid any open flame while doing this.

After the turpentine-paraffin has cooled to room temperature, add the half-gallon of penta concentrate, then the linseed oil. Finally, stir in the colors-in-oil slowly. When the batch is of uniform consistency and color it's ready to use. Apply it to the siding with a wide brush, stroking with the grain.

Four Painting Tips

YOU can convert an aerosol spray can into a refillable pressurized sprayer, handy for many small jobs, and build up the pressure with a tire pump each time you want to use it.

Choose a can with a perfect nozzle. Then salvage a metal tire valve with two threaded nuts from an old inner tube—or buy one at an auto-accessories store. If the valve has a broad base or flange, hacksaw this off so the valve can be screwed directly into a nut soldered over a hole drilled in the center at the bottom of the can. Place a rubber washer over the valve stem and turn it and the second nut up against the first nut. (Make sure all gas has been exhausted from the can before drilling the hole.)

To use the sprayer, remove the valve to half fill the can with properly thinned paint or lacquer. Replace the valve and inject air with a few strokes of a tire pump.—*Russell A. Dixon, Pittsburgh.*

MY HUSBAND, who is a professional painter and decorator, says the following procedure is the best he has ever used for removing paint from a piece of furniture:

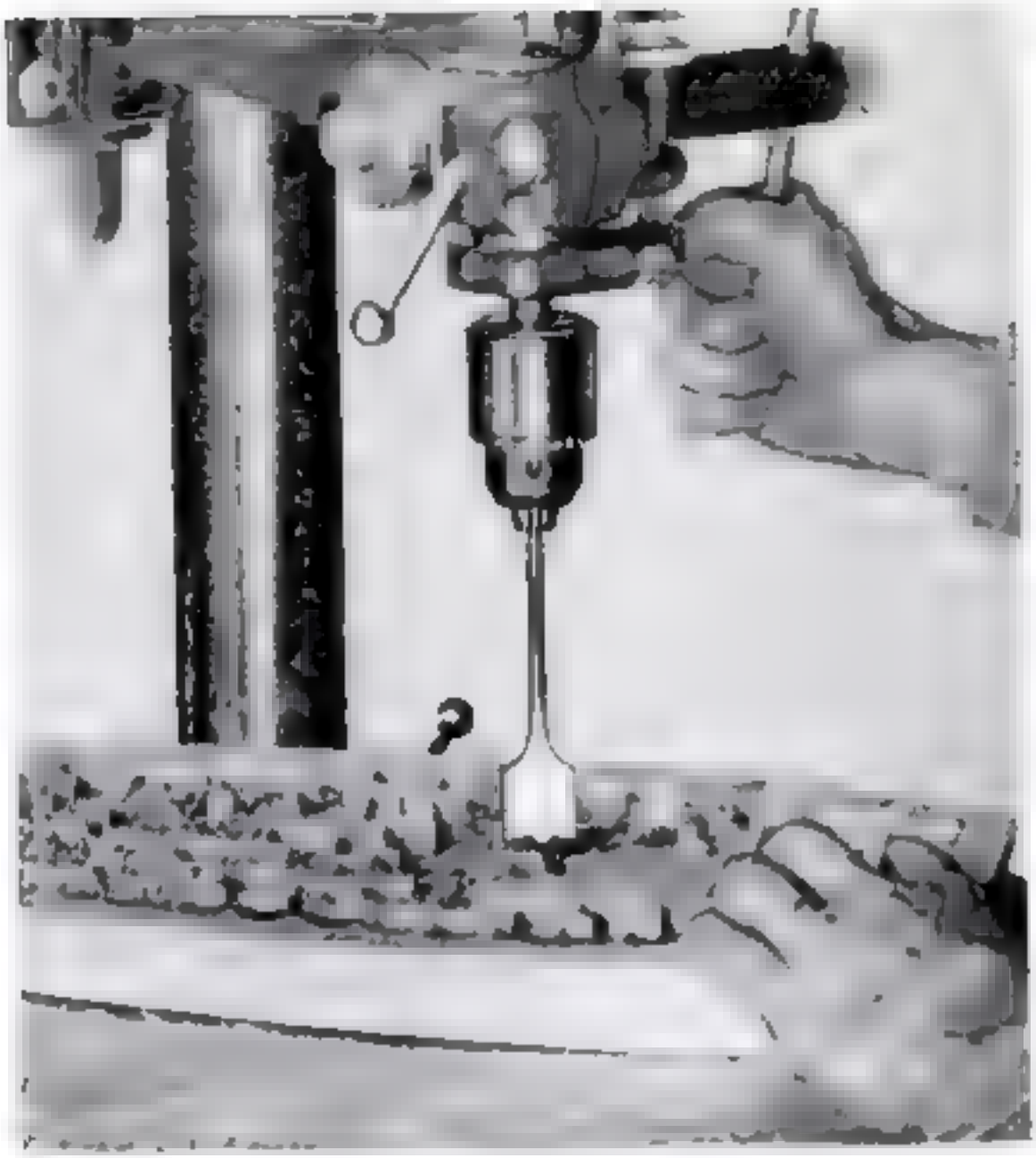
First apply remover that's designed to wash off. Let it stand 10 to 20 minutes, giving it a good chance to lift the old finish. Don't be too hasty in taking off the remover.

In the meantime, prepare a pail of warm solution, using one of the powders sold for washing painted surfaces (such as Soilax). When the remover has done its work, douse the area with the solution, using a scrub brush. Next, dip the wet brush in clean, fine white sand and scour the area thoroughly, using firm pressure. Then flush off the loosened finish with water.

Repeat the process from the beginning if necessary to remove the last bit of paint. A one-pound coffee can half full of sand is enough to do a good job on an average chest or table.—*Mrs. George A. Musculus, Manistee, Mich.*

NEED a good paintbrush? I did. So, meeting our local junk man one day, I offered to give him a nickel for every one that had a handle on it and bristle, no matter the size or condition. A week later he sold me a bushel basket full. After cleaning them, I had a selection of brushes, from ½" to 6", that would have cost a small fortune when new.—*Robert M. Caulkins, Waverly, Ohio.*

HERE'S how I applied a linseed-oil finish to an old oak rolltop desk. After sanding off the old finish, I brushed on a wash coat of linseed oil and paint thinner (50-50 mix). A second coat of 75 percent oil and 25 percent thinner was added the next day and allowed to dry overnight. A quick rubdown then gave a pleasing finish, easy to maintain. Scratches can be gone over with a little oil. —*Everett Lasher, Seattle, Wash.*



Short Cuts and Tips
FROM PS READERS

Rough Hollowing with a Flat Drill Bit

A FLAT drill-press bit cuts fast and makes a good roughing tool for hollowing wooden trays and bowls.

File down the center point of the bit until it is just a little longer than the outer spurs, and you can work close to the finished depth.

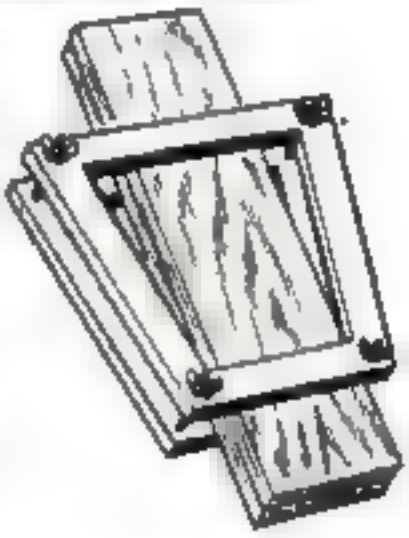
Bore slightly overlapping holes and knock out the blocks with a chisel and mallet. A light cut with a chisel or router will then flatten the bottom.—*Edwin M. Love, Palmdale, Cal.*

Collars Protect Tomato Plants

CARDBOARD cylinders cut from waxed-paper or toilet-tissue rolls will keep the cutworms away from your young tomato plants. Slit the cylinders down the side and snap them on the stalks, pressing into the ground.

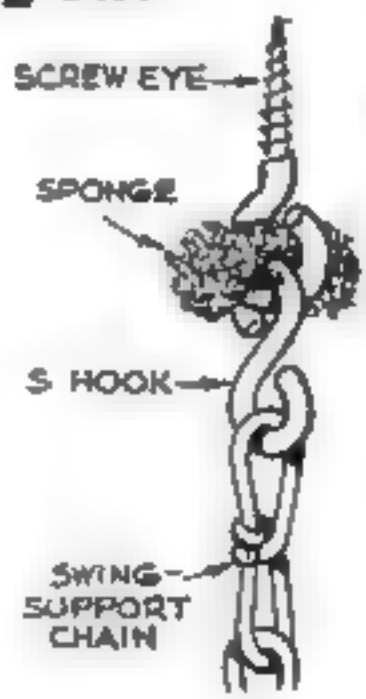
Glue Clamp for Emergencies

WHEN all my glue clamps were in use recently on a big shop project and I needed one more to accommodate thin material, I tried a tennis-racket press. It worked fine.—*John A. Comstock, Wellsboro, Pa.*



Long-Lasting Swing Oiler

BEING old-fashioned, we still have a porch swing—but it squeaks. I solved the problem of weekly oiling of the S hooks by forcing a wad of cellulose sponge into the screw eye and soaking it with oil. It now seeps without refill for months.—*Larry Fiedler, Cleveland.*



Getting Rid of Old Tin Cans

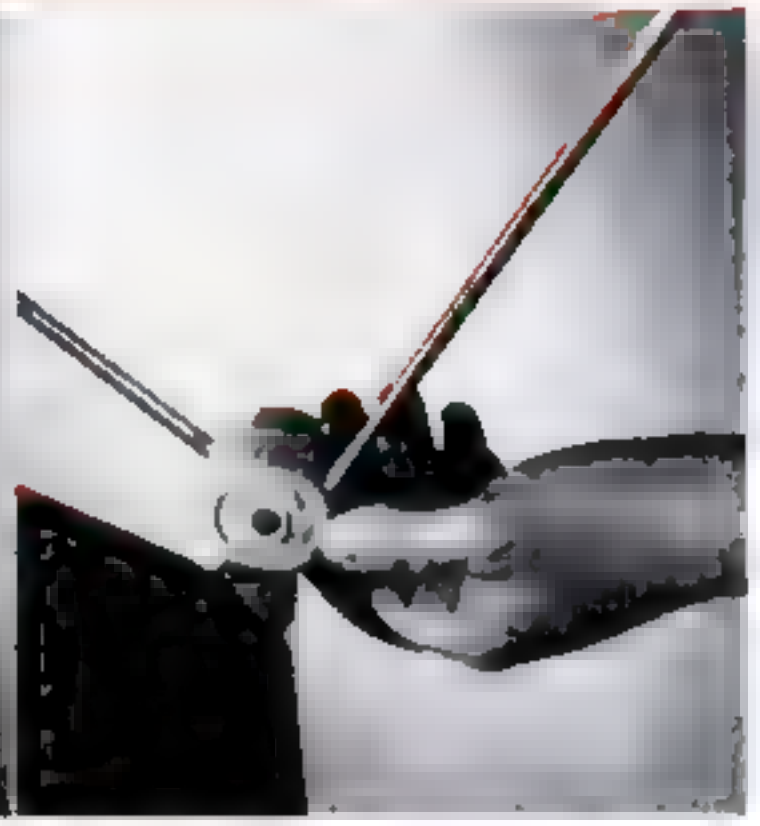
TIN cans accumulate rapidly on a camping trip and are difficult to dispose of.

One way is to cut open the bottom and flatten them. Then you can make them up into one or more small packages that can be easily carried home for the garbage pickup.—*Clinton R. Hull, Santa Ana, Cal.*

How Good Are Indoor TV Antennas?

MODERN STYLING has done more than electronic design to fit antennas into the home. These full-length rabbit ears fold behind plastic case that houses switch and shorter loop.

A SINGLE POLE often works as well as two in strong signal areas and is easier to adjust. This model telescopes into back of set so that only the switch is visible when it's not in use.



RABBIT EARS that attach to set can be rotated or tucked down behind the cabinet. Disadvantage: You can't move the antenna around the room to test for locations of best reception.

Do they work? Sure. A few dollars invested in one may bring in all the signal your set needs. But be wary of phony claims

By Robert Gorman

BEFORE you spend money on a fancy rooftop antenna, it will pay you to see what a pair of modest rabbit ears will do.

Outdoor TV antennas are better—no question about that—but, like the highest octane gasolines, they sometimes deliver superfluous "quality" that is scarcely worth the extra cost and bother.

Today's stronger transmitters and more sensitive receivers make indoor antennas more practical than in past years. If you live in a strong-to-medium signal area—up to 20 or 25 miles from a transmitter—the chances are that a living-room dipole may have as much pulling power as your television needs for good reception.

The advantages: An indoor rig is low in price, costs nothing to install, relieves your chimney of an unsightly nuisance, won't blow down or invite lightning, and can be moved anywhere you want it for best reception or portable use.

How useful are the gadgets, switches, coils and loops that festoon most current models? The answers may surprise you because many of the claims for indoor antennas are a lot of pure hokum.

Best without frills. The familiar tuned dipole has become a standard antenna design because it does two jobs well: It (1) plucks passing wave energy out of the air with high gain or "power," and (2) relays this energy to the receiver with minimum "impedance mismatch" which produces fuzziness, ghosts, loss of signal strength and other troubles. The combined length of a dipole's two horizontal arms is, theoretically, equal to half

PUSHBUTTONS take place of rotary switches on these modified rabbit ears. Telescoping center loop is said to aid tuning and adjustment.

the signal wave length of the particular channel being received.

In outdoor antennas, engineers can increase signal pickup many times by adding stacks of extra arms of different lengths and carefully adjusting their angles to the incoming waves. But all this takes a lot of metal and a lot of space. There is just no practical way of providing this for an indoor antenna.

Despite claims of increased "power," gain or sensitivity, no indoor antenna yet invented can match the signal-grabbing ability of the simplest outdoor dipole. But the plain, no-frills, full-length rabbit ears comes the closest.

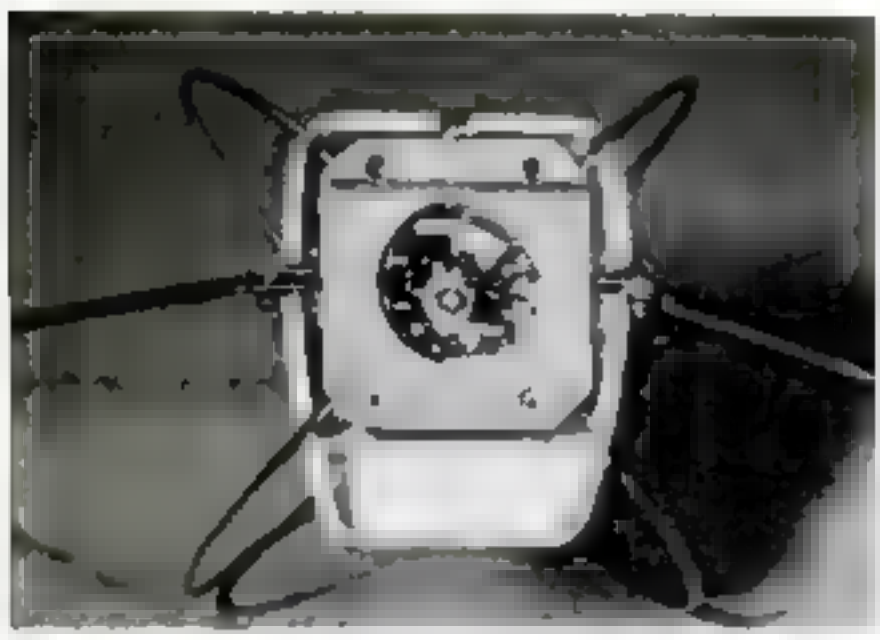
Are indoor rigs getting better? Basically, engineers have followed two main paths in their attempt to improve indoor reception. One school has tried to make antennas smaller and more maneuverable without sacrificing too much signal gain as compared with full-length rabbit ears. The other school of antenna design has fiddled with anything that seemed to improve reception.

The first approach is based primarily on outdoor-antenna theory. Brought indoors, this means that, to function well, the arms of a dipole must be opened horizontally, turned broadside to the TV transmitter and extended to exactly half its wave length.

Since wave lengths range from 56" for Channel 13 up to 213" for Channel 2, it's obvious that few rooms would let you stretch an indoor antenna to even half a wave length without banging into walls and knocking over lamps. Moreover, few televiewers know the right length for each channel or want to be bothered finding it out. So while rabbit ears may be

SPIRALING the long, low-channel element of this "Hi-Lo" antenna around the shorter high-channel element is said to give the same effective reception as a long straight-line dipole.

COILS AND LOOPS frequently help an indoor antenna pick a usable signal out of scattered waves that bounce around inside a room. Switches in many antennas connect loops and arms in various combinations to get best results.



SPACE IS THE MAIN PROBLEM in orienting and tuning rabbit ears because performance is re-

tuned dipoles in theory, they seldom are in practice.

Making the long short. To compensate for this, some engineers have tried to squeeze rabbit-ear performance out of shorter antennas. One popular model spirals the long, low-band arms around the shorter high-band ones to save space. Others, such as Channel Master's "Showman" and Amphenol's "Vi-Fi," compensate electronically for the impedance mismatch that causes most of the signal loss in short-arm dipoles.

When the arms are less than half a wave length, an antenna acts as if a capacitor has been wired across its feed points. In both the Showman and the Vi-Fi, this unwanted capacitive effect is balanced by variable inductances—wire-wound coils with movable slugs. Both antennas also have built-in matching transformers to provide a closer match to receiver input than you would normally expect to get from even a full-length tuned dipole.

Other parties heard from. Engineers of what might be called the second or "tinker" school of antenna design take a dim view of applying outdoor theory to indoor use.

In the very process of passing through a wall, they argue, a TV signal breaks up. Even if a complete wave did get into

lated to the length of exposed metal. A half-wave dipole for Channel 2 would extend over 100". These arms—like most—are much shorter, yet even a six-foot man can barely touch the ends.

a house, it would be scattered by bouncing off walls and furniture. Very often separate lobes of the same wave are reflected so as to cancel each other out.

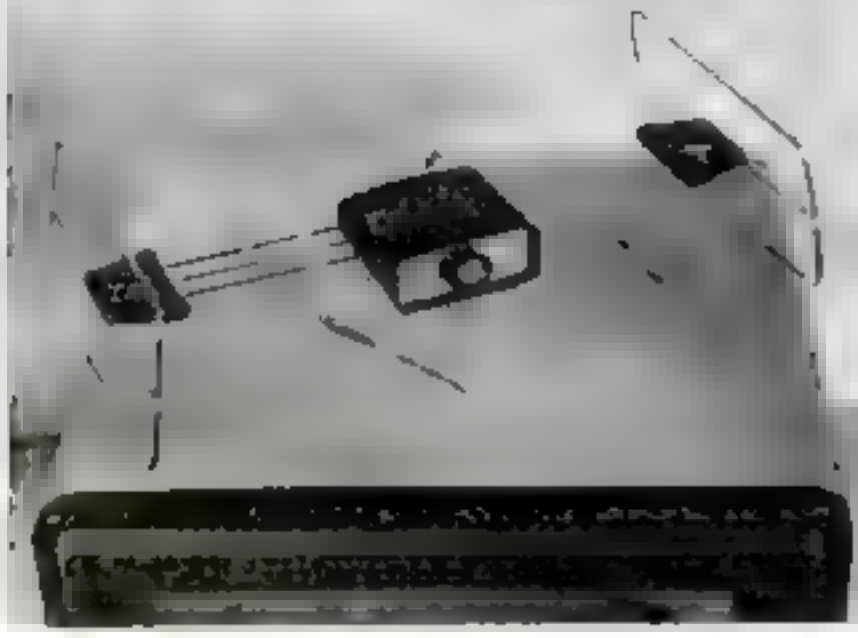
Oddly, part of an antenna can often deal better with this kind of mess than a whole one. It gets less signal, but by blocking scattered reflections it may put a clearer picture on your screen.

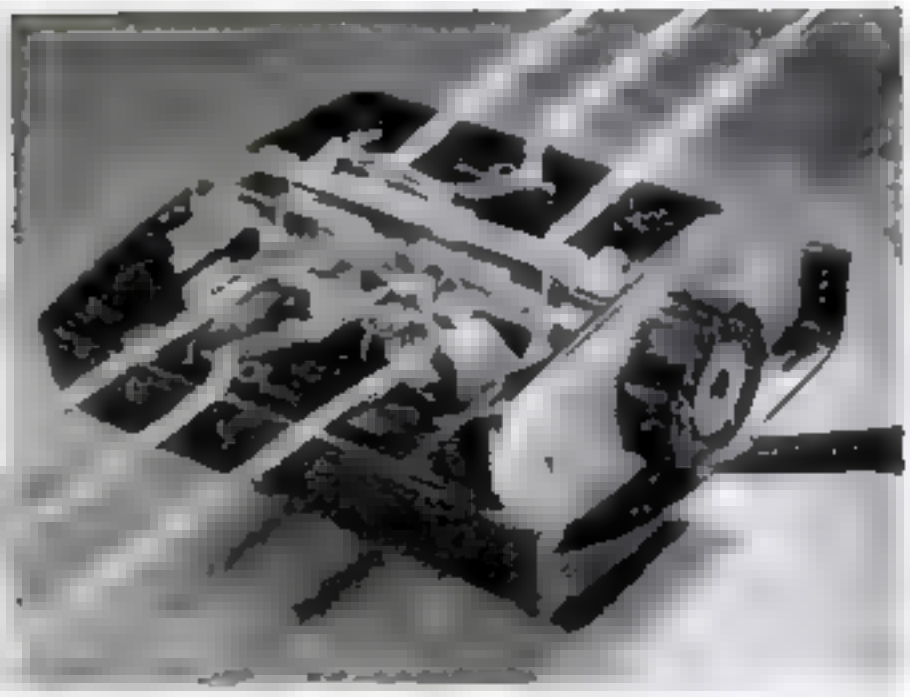
This is why some manufacturers have tacked assorted switches, wire loops and other gimmicks onto standard rabbit ears. On all tricked-up antennas, there's one switch position that connects the arms in the conventional way. Other switch stops connect the arms separately or in combination with a loop or coil that may have some load-balancing effect. Some even incorporate a "dead" switch position that shorts out the antenna completely—for whatever good that does to your reception.

The point is that these oddballs *do* work. By angling their arms, swinging them in different directions and fiddling with the switch, you frequently hit the bell-ringing combination that brings in a fine picture. In or near cities where weak signals aren't a problem but reflections are, such goofy-seeming contrap-

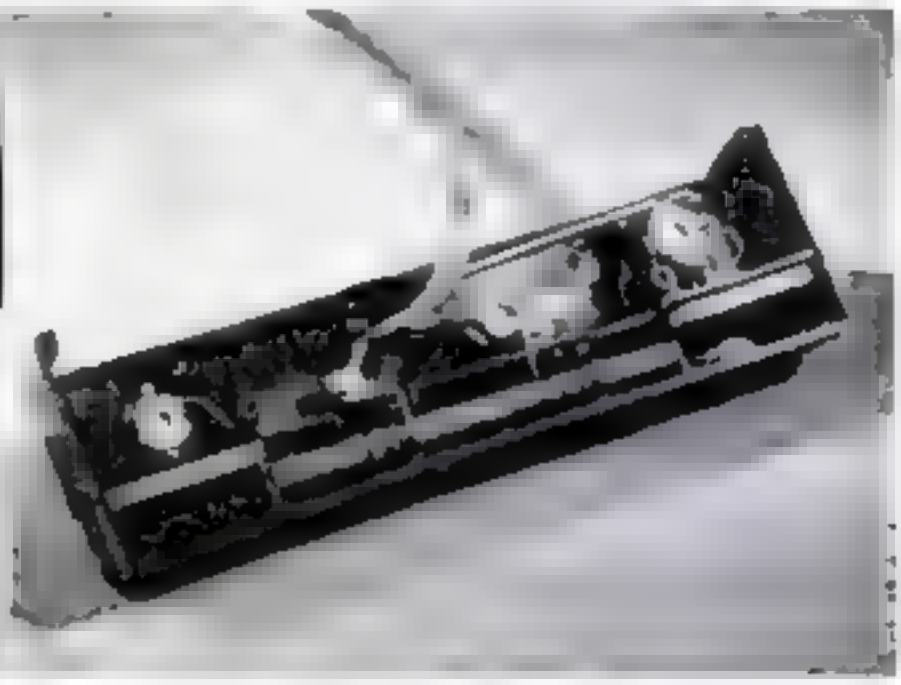
Check These Points Before You Buy an Indoor Antenna

- ***Rabbit ears*** should open out to at least 80", and longer ones would be better for tuning the lowest channels.
- ***Telescoping rods*** should be free of sharp points or edges. They should slide easily but not sloppily; loose rod contacts can cause "noisy," jumpy pictures. Arms of brass or steel will usually work best.
- ***Ball or swivel joints*** should permit horizontal (or nearly horizontal) adjustment. Some forward-V positions are also desirable for tuning out ghosts.
- ***Free-standing antennas*** of some makers may be prone to topple when arms are extended. If the base isn't weighted, check for balance.
- ***Switches*** rarely provide more than three or four significant choices, so extra switch positions probably won't do anything useful. If there's a switch, test it for solid, positive "feel"; loose contacts weaken the signal. (Slug-tuned models may have knobs but no switches, so these points don't apply to them.)





CHANNEL MASTER'S "Showman" is one of a few shorter antennas engineered to minimize signal loss. Rectangular wire "hats" on the ends add some electrical length, and impedance mismatch is compensated by a built-in transformer and a variable-inductance tuner. The "switch" tunes the antenna by moving a powdered-iron slug inside a wire-wound plastic cylinder.



AMPHENOL'S "Vi-Fi" is theoretically similar, though different in appearance. It has two shortened (27") rabbit ears that telescope into a neat plastic case. A slide-rule type of variable-inductance tuner helps to balance out the capacitive-loading effect of short-arm design. The four-wire, flat-ribbon lead-in incorporates an impedance-matching network.

tions may actually perform better than costly antennas because they let you "tune out" ghosts that plague a good but nonadjustable rooftop rig.

Picking the best. Both approaches to antenna design make sense, but individual models vary widely and some may solve your own particular problems better than others. Before you settle for one, try to arrange with your dealer to let you try three or four types, then return the ones that work the least well.

The so-called "hideaway" type that attaches permanently to the back of a set has become popular because it doesn't clutter the room when it's not in use. But, of course, you're prevented from moving it around. Stand-based models give you more opportunity to find the location for best reception. If you buy the latter type, be sure the lead-in to the set is long enough to give you real freedom; skimpy leads keep the antenna tied too close to the set. Lead-in length is not critical within reasonable limits.

Surprisingly, outward appearances do talk. A good-looking, nicely finished unit is also likely to have better quality in the parts you can't see.

One caution, though: Don't let a big "discount" influence your choice. So-called "list prices" on most indoor antennas are 14-carat hogwash, simply jacked sky-high so dealers can sell you a "big bargain." Indoor antennas retail —with or without discounts—from about 75 cents up to $10 or $12 for the flossiest, best-constructed models. Three or four dollars should be about right for good-quality, switch-type rabbit ears. END

11 Fishing Tips

YOUR CATCH WILL STAY FRESH LONGER if you thread light rope through the gills and trail the fish overside. At the end of the day, haul them in and drop them into a plastic vegetable bag. Add a little water and tie the bag tightly with string.

KEEP FISH HOOKS SHARP by rubbing them on a disk of fine emery cloth cemented to your rod's butt.

LURES MUST BE IN TOP SHAPE to bring in the fish. Remove loose screw eyes and force plastic aluminum into the holes. Reset the eyes and let dry overnight. Apply auto paste wax to lures as well as metal spinners to keep them new looking.

A NEW RUBBERIZED GRIP can be applied to an old rod. Saturate heavy cord, such as mason's line, with plastic rubber and wind the cord around the handle. Allowed to cure in a warm place, it will set to form a ribbed grip.

POCKETS IN YOUR FISHING JACKET can be rubberized and made waterproof by pulling them inside out and working plastic rubber into the weave of the fabric.

FORGET THE MOSQUITO REPELLENT? Tuck short lengths of fishline in the band of your hat and let them dangle 8" over the brim to keep bugs away from your face.

A TELLTALE TRAIL often follows leader knots as they're pulled through the water. Press warm wax around the knots to streamline them and eliminate the warning bubbles.

A HANDY DRYER FOR FISHLINE can be made from a wire coat hanger. Bend it into a square, wind the line around it and hang it up to dry.

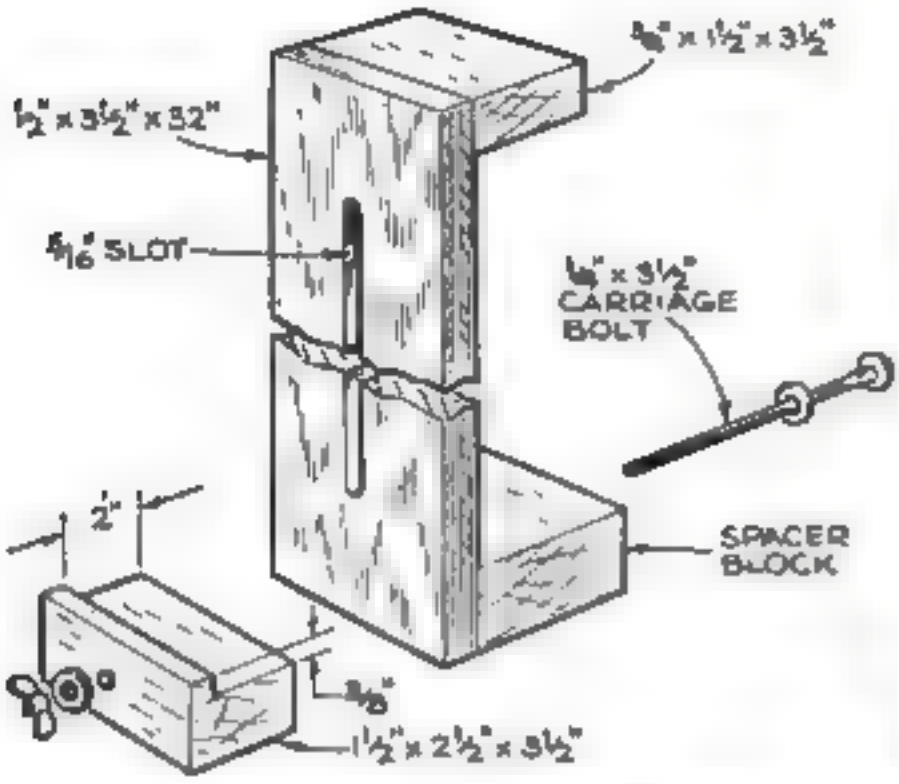
TO WATERPROOF INEXPENSIVE LINE, draw it through a wad of cotton moistened with silicone shoe dressing sold at shoe and department stores.

A DRIP DEFLECTOR saves temper. Ever accidentally dip a cane pole in the water, then raise it and have water run up your arm? Cut a hole in one half of a rubber ball and slip it on the pole as a guard.

A STURDY CASE FOR A FAVORITE ROD can be made of aluminum tubing. Permanently close one end with a wood plug and cap the other with a large cork tied to the tube with a slack string.

Short Cuts and Tips

FROM PS READERS



Adjustable Holder for Supporting Long Boards on Bench

It's hard to joint or rabbet a long piece when there is nothing to support the outboard end, but it can be easy if you make an adjustable holder that will work with boards, table tops and plywood.

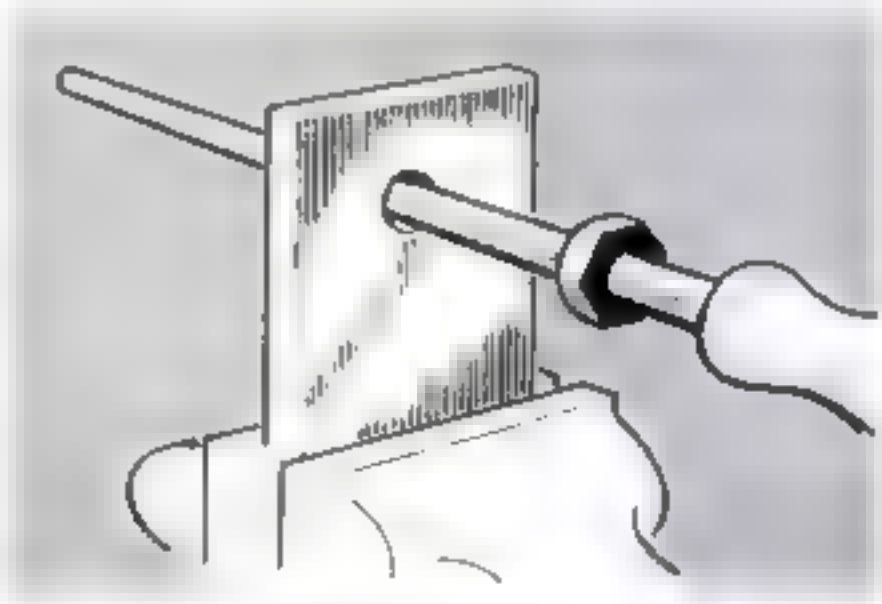
Slot a ½"-plywood strip to admit a sliding ¼" carriage bolt. Then glue a ¾" block to the upper end to hook over the bench and another at the bottom to hold the strip vertical against the front. In use, clamp one end of the board in the vise, slide the support up against the other and lock it in place with the wing nut.—*Edwin M. Love, Palmdale, Cal.*

▶▶▶It's easy to tighten a sagging cane chair seat. Shrink it with hot soap suds sponged on and then rinsed off with hot water. Let it dry thoroughly before use.

▶▶▶Grooves between insulated ceiling tiles are a place for dust to collect. You can prevent this by applying a thin coat of white shellac between the tiles.

Spreading Glue with Spatula

A rubber kitchen spatula is useful for applying glue quickly over a large area. You can clean it easily, but if the glue does dry, it can be broken off by flexing the blade.—*C. C. Cooley, Detroit.*



Stop on Rattail File

You can keep a round file from jamming in a hole you are enlarging by forcing a nut over it. This acts as a stop to keep you from pushing the file too far into the hole.—*F. Murray, Chicago.*

If Your Power Steering Acts Up...

. . . here's how to spot the trouble, and perhaps get rid of it

WHEN the steering wheel seems to go dead in your hands, chances are that one of two things is wrong with a power-steering setup. The fan belt may be slipping. Or the fluid level may be low.

Check the fan belt

The fan belt is a key part of a power-steering setup. Besides the fan and generator, it drives a pump to force fluid under pressure through the steering-assist system. On some cars the pump may have a belt of its own. But either way, a belt transmits power from the engine—and it must be tight to do so.

You can check the belt by standing beside the car and turning the wheel hard over with the engine idling. This builds up maximum pressure in the system and if the belt is loose, you'll see it slip over the pump pulley after you've held the wheel cramped for a second or two. You may feel it, too, because a slipping belt often makes the steering wheel wiggle in your hand as you turn it.

To tighten the belt, loosen the lock bolt and force (or pry with a stick) the generator or power-steering pump outward against belt tension; then hold it while you tighten the bolt.

If this fails to restore steering effort, the next step is to check for low fluid or air in the system.

Check the fluid

Whenever you turn the wheel, a valve opens to let oil from the pump press against a piston to help you steer. If fluid is low, the pump runs dry; and if there is air in the system the full hy-

draulic effort can't be applied to steering.

Remove the reservoir cover and add fluid to the full mark. If the level is very low, air trapped in the system may cause a dead spot in the steering. To bleed the system, run the engine at idle and turn the steering wheel quickly from side to side to the limits of its travel. This releases the air into the reservoir (you'll see bubbles rising), and you may have to add more fluid to replace the air that's been worked out of the hydraulic passages and again bring the level to the full mark.

Caution: When checking the power-steering fluid, take great care not to allow dirt to drop into the reservoir.

Check the tire pressure

Over- or under-inflated tires can create odd steering sensations. Too much air gives an oversensitive or "floaty" feel to steering, making you feel you're driving on ice. Soft tires make steering difficult. Power steering may lessen the effects, but it won't cancel them out.

Check the wheel alignment

Front wheels out of alignment, combined with lack of lubrication in the front-end linkage and ball joints, will make your power-steering unit—and you—work harder. Look for irregularly worn front tires as a tipoff to an alignment problem, and bounce the front end up and down while you listen for groaning bearings to tell you that they're dry. Failure to recover readily after a turn suggests the same ills.

Listen for noises

Whenever you cramp the wheel hard over, either to the limit of travel or against the curb, you will hear the light, hissing sound of the pressure-relief valve recirculating oil back into the reservoir. That's the only normal noise you should hear. Noises you shouldn't hear include:

- Loud chirping, a staccato squeal caused by a slipping belt.
- Thump or rumble, caused by a frayed belt that should be replaced.
- Chatter or hollow rattling, caused by low fluid level or air in the system—usually accompanied by intermittent loss of steering assist.

Any trouble that can't be cleared up by making these simple checks is probably a mechanical defect within the system, best repaired by a specialist. But at least you'll have the satisfaction of knowing you've checked the big trouble-makers before you go to a garage.

Four main points of power-steering upkeep

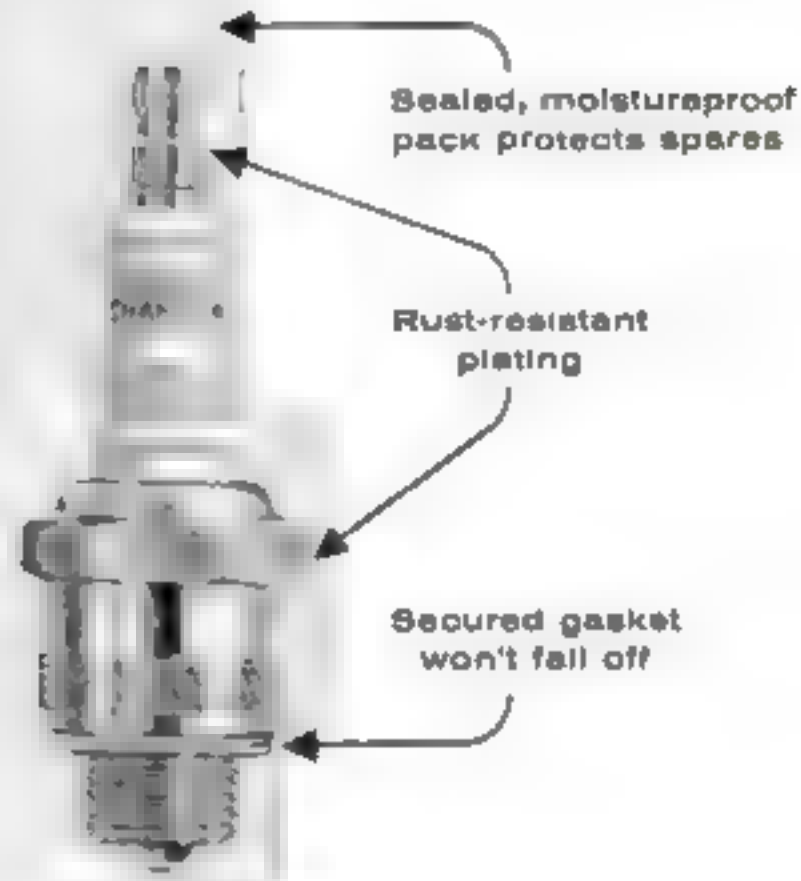
1 **Check the fluid** in the reservoir every 1,000 miles or so. If it's consistently low, look carefully for leaks along hoses and fittings.

2 **See that hose doesn't touch** the body or frame; besides danger of chafing, contact between hose and metal can transmit annoying pump noises to the inside of the car.

3 **Check fan-belt tension** occasionally. If your garageman has a torque wrench, have him apply it to the pulley bolt. The pulley should slip at no less than 25 foot-pounds.

4 **Change the power-steering fluid** every 25,000 miles. Any fluid that does enough work to get hot tends to break down after a long period of use.

Don't start this year's boating with last year's spark plugs!



Before you take to the water, replace those old plugs with new plated Champion marine spark plugs. You'll get full power . . . easy starting . . . and more hours of fun from a tank of gas!

Those old spark plugs of yours have fired millions of times.

In an outboard, for example, during *one hour* of running at 4000 rpm, a plug fires 240,000 times. That's almost *two and one-half million* times in just 10 hours. And every single spark is like a tiny lightning bolt—slowly but surely blasting away the firing points of a plug. The gap between the electrodes finally becomes so big a spark can't jump it every time.

When that happens, your plugs begin to misfire. Fuel is wasted. Power is lost. Your motor runs rough. It's hard to start. But don't blame your motor. And don't blame your old plugs. They've done their duty. Retire them.

Replace them with plated marine Champions. All exposed metal surfaces of these new silver-colored Champions have a special protective finish that guards against rust. Another special feature is a secured gasket that won't drop off during installations. These new Champions are excellent for carrying as spares, too. They're the *only* spark plugs in a completely waterproof pack.

And Champion Spark Plugs are tops in performance. For example, the last 13 Gold Cup races were won with Champions. In the 1958 National Stock Outboard Championships at Miami, 9 of the 10 class winners were powered by Champion Spark Plugs.

It costs very little to be sure of the power that can give you a million dollars' worth of boating fun. So start this summer with a fresh set of the world's finest marine spark plugs—*Champion Spark Plugs.*

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DEPENDABLE 5-RIB **CHAMPION** *SPARK PLUGS*

EVERY MAJOR OUTBOARD MAKER USES CHAMPION SPARK PLUGS

Gus Challenges an Electronic Marvel

By Martin Bunn

THE middle-aged convertible, top down, rattled into the Model Garage. In the front seat were two young men. In the back was stowed enough fishing gear to equip a rod-and-reel club.

"Drop everything, Gus," said the driver.

"We're going fishing," said his companion.

Gus looked up from a tune-up job into the grinning faces of the Biddle twins, Tim and Tom, one crew-cut, the other shaggy-headed. They had been in Gus Wilson's hair on and off for years since he had fixed their first roller skates.

"Go and get lost," he said. "Just because you two are home from college for Easter vacation doesn't mean that other people don't have work to do."

"You promised to go fishing with us," said Tim.

"Our date was for the opening of the trout season next week," Gus said. "Now I've got a tough engine job to tackle."

"If the truth were known, Gus," said Tim, "I'd bet 10 to one your assistant, Stan Hicks, is the real mechanic here."

"He'd welsh on the bet," Tom put in, getting out of the car. "Remember last year how he wouldn't pay off when we bet we'd catch the limit before he did?"

"Pay off!" said Gus in mock indigna-

"Ignition trouble?" asked the salesman. "Let me show you the latest in testing equipment."

PROOF

ON YOUR DIPSTICK

HASTINGS

KEEPS OIL CLEAN

Hastings Oil Filter Cartridges keep oil clean from filter change to filter change, when replaced as normally recommended*

That's because only Hastings has Densite filtering material, which traps and holds even the most microscopic dirt particles. The dipstick test proves it!

Just ask for Hastings—next filter change. Be sure of clean oil *all* the time.

* Proved by tests conducted in accordance with U. S. Bureau of Standards.

U. S. Patent Numbers 2,797,811 2,684,771

HASTINGS

OIL FILTER CARTRIDGES

HASTINGS MANUFACTURING COMPANY
HASTINGS, MICHIGAN

tion. "After I found that you two cheaters had bought half your fish from a 10-year-old boy!"

The twins looked at each other and roared with laughter.

GUS grinned. "Why don't you double jokers go and bait some fish instead of me."

"Can't," said Tim. "We've got trouble."

"Car trouble," echoed Tom. "If you're a better mechanic than fisherman, Gus, fix it."

"Okay. Anything to get rid of you. Your old tin can did sound a bit rough coming in." He lifted the hood.

"Hold it!" came a peremptory voice. The trio turned and saw a small, rotund, round-faced young man, one arm raised and the other holding a small suitcase. He didn't look much older than the Biddle twins.

"Hold it!" he repeated, coming into the shop, lowering his arm and pointing toward the convertible. "Ignition trouble —I hope?"

"Could be," Gus said, "but . . ."

"Then let me show you the latest in testing equipment," continued the newcomer, setting his grip down. He reached out a pudgy hand that was lost in the garageman's oversize paw. "Gus Wilson, I presume. My name's Anderson—Bill Anderson. V&L Automotive Electronics."

"Yes," Gus said. "I had a letter from your company, but I expected . . ."

"An older salesman?" broke in Anderson. "We're a young firm, Mr. Wilson, in a young business. I'm just out of electronics school, myself." He hoisted his case on the shop bench, opened it, and lifted out a neat metal case with knobs and dials.

"A portable TV," said Tim Biddle.

"Wonderful," put in Tom. "Let's take it fishing with us—when you fix our car, Gus. You come along, too, Mr. Anderson."

"Behave yourselves, boys," Gus admonished. "This isn't a TV set. It's an oscilloscope. An ignition analyzer."

The salesman looked surprised. "Oh, you're familiar with this equipment?"

"A little," Gus said modestly, filling his pipe.

"Ah," said Anderson, going into his spiel. "Then you know that the electronic ignition analyzer is essentially the same

as the oscilloscopes that have been used for years in testing electronic equipment."

He paused, flustered. The Biddle twins were grinning, fascinated by the polka-dot bow tie riding up and down on the little salesman's plump throat as he spoke.

Anderson looked at some cards he had pulled out of his pocket, coughed and continued. "Rapidly changing electrical voltages are converted into a visible 'trace' across this TV-like screen. My scope dramatically portrays the sequence of events in the ignition cycle and reveals at a glance the faults that could otherwise be located only after a time-consuming, step-by-step procedure."

HE UNFOLDED a chart. "This chart pictorially shows what the sweep pattern looks like with various ignition troubles—bad spark plugs, coils, condensers, distributor points, wiring."

"That's very educational, Mr. Anderson," Tim Biddle said as the salesman put down the chart. "But we're on vacation and want to go fishing. How about some action?"

Anderson beamed. "Ah, yes, a demonstration. Now we'll analyze this engine electronically and get you young fellows on your way."

The salesman placed the instrument on a fender and hooked a test lead to a spark-plug wire. He explained how the pulse from the wire triggered a circuit to provide a horizontal sweep across the face of the cathode-ray tube.

"The wire across the distributor breaker points," he went on, "provides a varying voltage to the vertical sweep circuit of the instrument, showing the voltages across the ignition points at any instant. Now, if somebody will start the car . . ."

Tom Biddle obliged. Anderson made some knob adjustments as Gus listened to the roughly idling engine. Then he looked at the scope pattern. There were eight pips on the screen; all appeared to be of the same size and shape.

Anderson frowned. "Hmm. I expected to find one or more of the pips sloughed off, indicating bad plugs. Let's stretch out the presentation and examine each pulse more closely." He checked off: "Point spring tension regular, no condenser trouble, no excessive distributor-shaft wobble, wiring okay." He looked up. "Mr.

USING TOO MUCH OIL AND GAS?

IT'S TIME FOR HASTINGS

When your oil and gas bills start growing bigger—look out! Using too much oil is your first sign of worn-out piston rings. And worn-out rings mean power drop-off—costly waste of oil and gas—and expensive repairs later on!

The sooner you act, the less it will cost. See your motor specialist the minute oil-pumping warns you there's trouble ahead. When he recommends new piston rings, ask him for Hastings. They're engineered exclusively for replacement service . . . to provide the additional lubrication worn engines need . . . to stop oil-pumping, save gasoline, restore lost performance.

Get new car power and performance from your present car—with Hastings. Truly your best investment for many thousands of extra miles of trouble-free driving pleasure. Hastings Manufacturing Company, Hastings, Michigan. Piston Rings, Oil Filters, Casite, Spark Plugs.

HASTINGS

PISTON RINGS

TOUGH on oil pumping GENTLE on cylinder walls

Wilson, the trouble with this car is not electrical."

"I'm no electronic marvel like this gadget of yours," Gus said, "but let me try something." He turned off the ignition, scanned the spark-plug wiring, and huddled over the distributor.

"There," he said. "Unless I miss my guess, the trouble *was* electrical." He hit the starter. The engine caught, ran roughly for a moment, then settled down to a smooth idle.

"April Fool, Gus!" Tim shouted gleefully. "See, Tom, I said Gus could do it."

Gus groaned. "Oh, no! I should have guessed."

"Huh?" gulped a bewildered salesman.

"Son," Gus said, "you and I have been the victim of a practical joke. This is April first, and we've been April-fooled —but good."

The Biddle twins guffawed. Gus relit his pipe. Anderson replaced his instrument. "I know when I'm licked," he said.

"This has nothing to do with you," Gus said. "These two jokers have pulled the oldest automotive practical joke in the book. They switched two spark-plug wires. For years I've 'fixed' cars with that trouble the morning after Halloween."

"But how did you locate the trouble so fast?" Tom asked.

"Well, Tom, your brother had the car in here two weeks ago for a tune-up. New plugs, condenser, points—the works."

"That was the weekend I didn't get home," Tom Biddle said. He took a playful punch at his twin. "You old cheat. No wonder you bet me that Gus would spot the trouble in less than 10 minutes."

ANDERSON slammed down the lid of his suitcase. "Screwballs," he muttered. "Why didn't you give me a hint, Mr. Wilson, before I made a fool of myself?"

"You hardly gave me a chance, Mr. Anderson. I've had an oscilloscope for quite a while. Had one of the first to come out. But like any tool, it's not a cure-all."

"I realize that, Mr. Wilson," admitted the salesman. "But about this trouble?"

"Why, you just backed right into about the only ignition trouble I've found that most oscilloscopes won't detect. Some of the more expensive ones will, but not yours or mine.

"If these characters had driven around the block a few times and fouled the plugs, your scope would have picked it up immediately. In this case, it told only that the plugs were firing, not *where*."

". . . or you can unhook it and use it as a handy portable radio."

"Thanks for the lesson, Mr. Wilson. Maybe I am kind of green."

Gus grinned at the salesman. "Are you a fisherman?"

"Yes. But why?"

"Because I'm charging these pixies eight dollars. That'll more than pay for our fishing licenses."

"We'll pay you in fish," Tim Biddle shouted over the roar of the motor as he backed the car out of the shop.

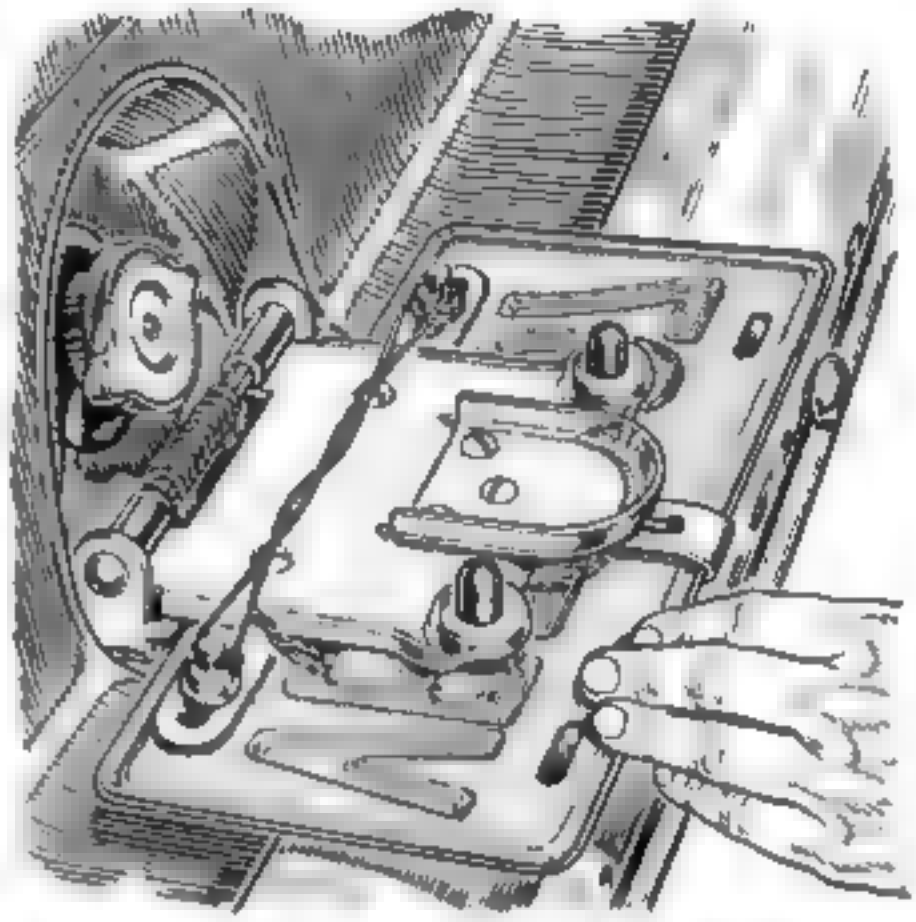
"It'll go on their bill," Gus said grinning, "just to teach them a lesson." He shook the salesman's hand. "I'm sorry for the hazing you took, Mr. Anderson. Stop by again. My scope won't last forever. And bring your fishing gear along."

"I'll have it, Mr. Wilson—and maybe a better sales line to tackle you with." END

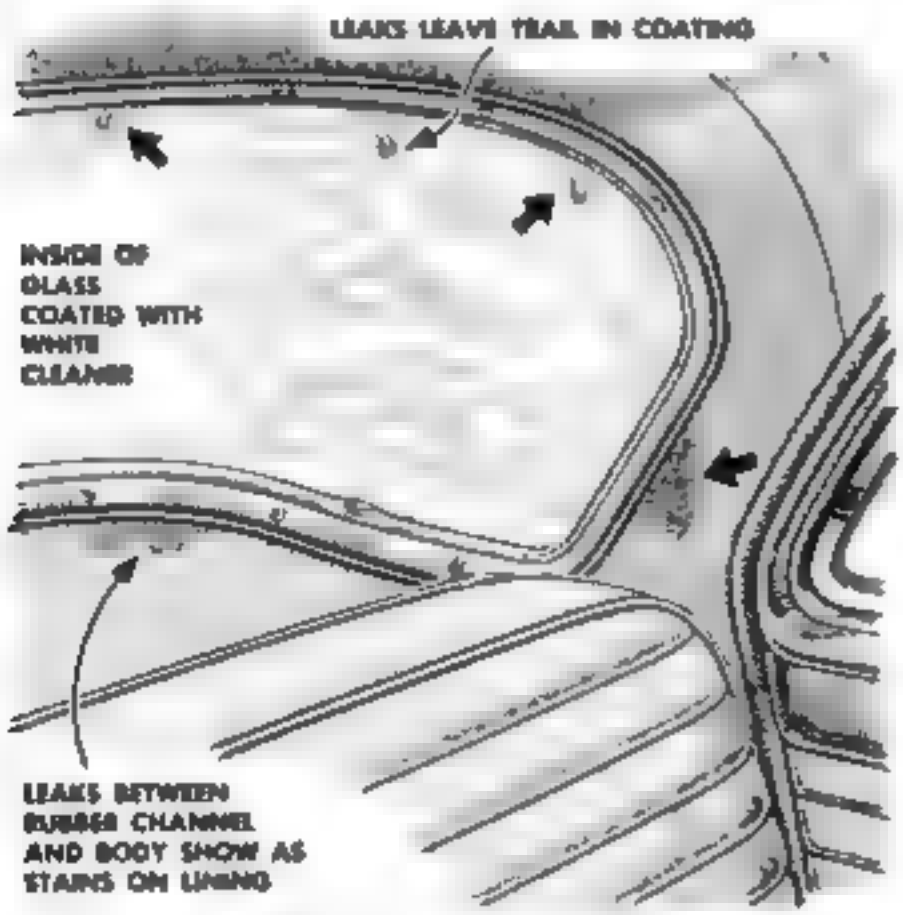
Next Month: Gus cracks a tough nut.

Hints from the Model Garage

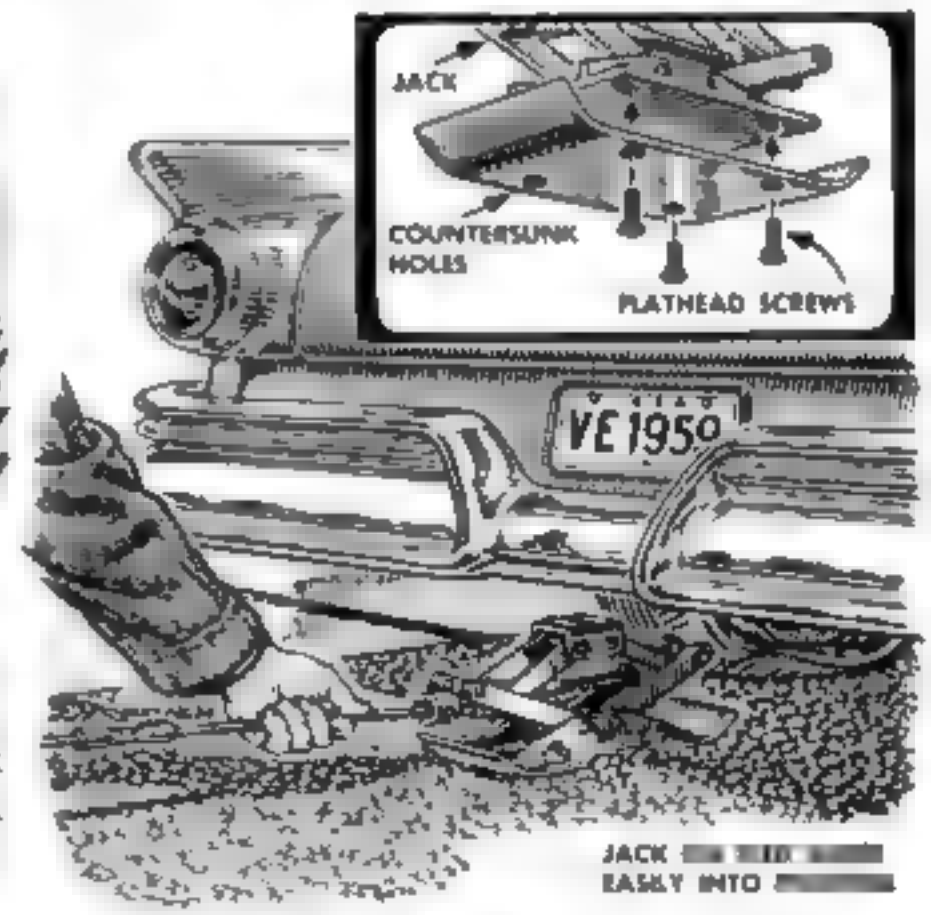
Grease fittings can be kept clean between lube jobs by pressing little squares of household aluminum foil over them. Covering the fittings takes no longer than wiping them clean, and eliminates the danger of forcing grit into the bearings.



License plates can't be lost if you safety-wire the bolts as airplane makers do. Drill small holes through the bolt shanks and thread a loop of wire through the holes after tightening the nuts. Even if nuts loosen, they can't come off.



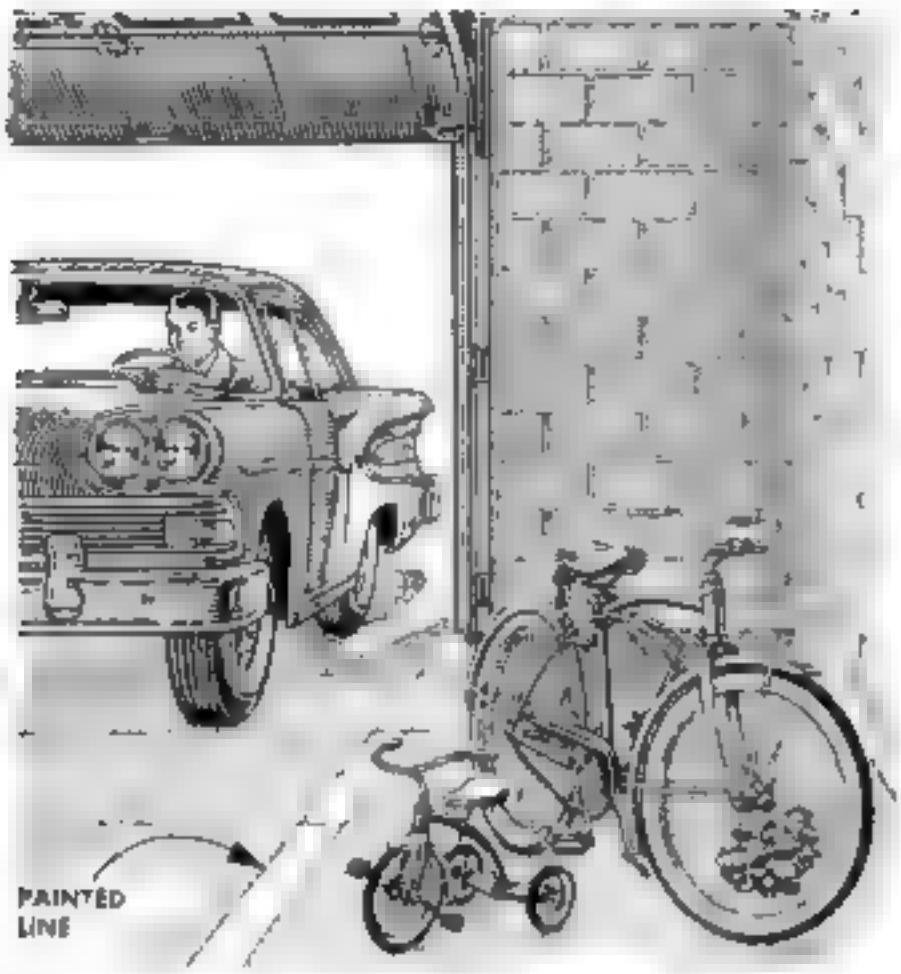
Hard-to-find leaks on rear window or windshield will leave a telltale trail if the inside of the glass is coated with a glass cleaner that dries to a white powder. After coating, play the garden hose over the outside of the glass to force water in.



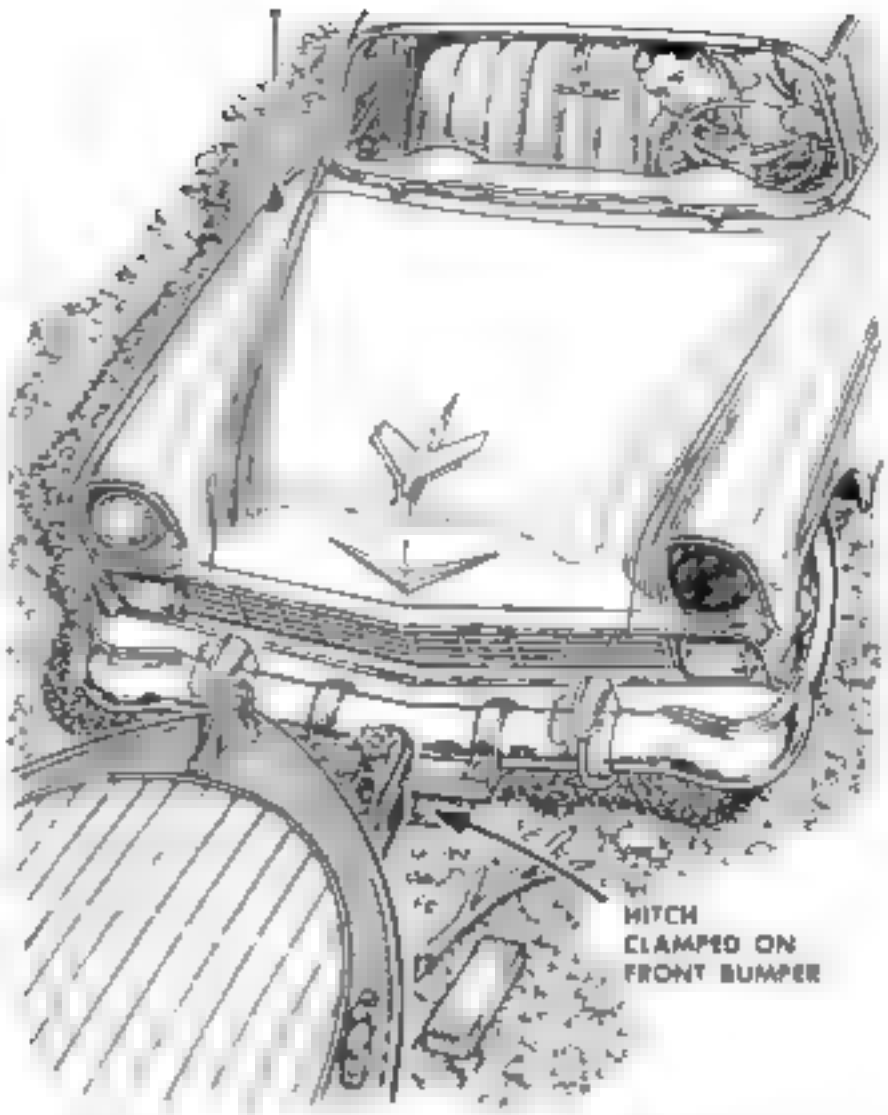
A sled-like base of heavy sheet metal fastened to the bottom of a jack will keep it from tipping and help it slide easily as it is pushed under the car over gravel or loose earth. The base also minimizes sinking into soft earth.

Please turn the page for more auto hints

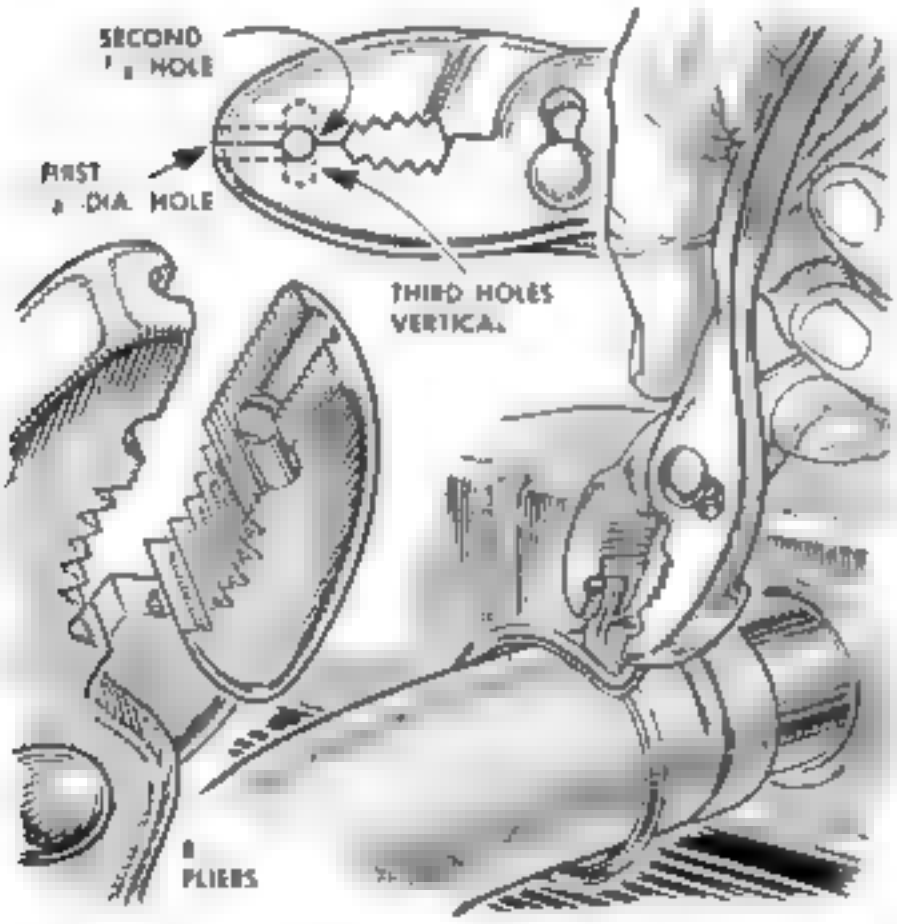
More Hints from the Model Garage



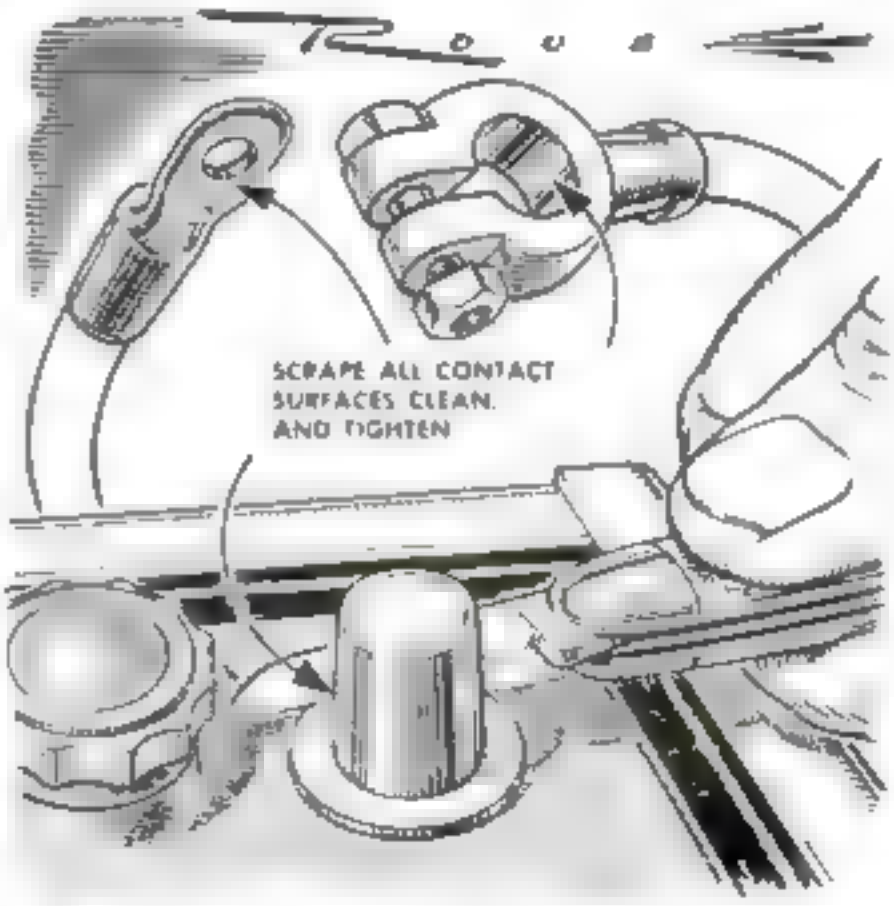
Painted guide lines that keep parking lots orderly can do the same for your garage. Using a board as a straightedge, roll or brush on two lines to indicate the space required for the car. Tell the kids the remaining space is theirs.



Where maneuvering is tight or the beach very shallow, try hooking your boat trailer to a hitch clamped to the front bumper. With this setup, you can quickly correct the trailer if it drifts off course, and push it right to the water's edge.



Make a handy hose-clamp tool from inexpensive slip-joint pliers by drilling three 1/8" holes. Clamp the jaws and drill one hole from the end, another in from one side. Open the jaws and drill each where the first two holes intersect.



When lights burn out mysteriously, check for loose battery connections or a corroded ground strap. (An intermittent bad connection can result in generator-caused overvoltage.) Scrape all surfaces bright, and tighten for good contact.

Short Cuts and Tips
FROM PS READERS

Clay Clamp for Soldering

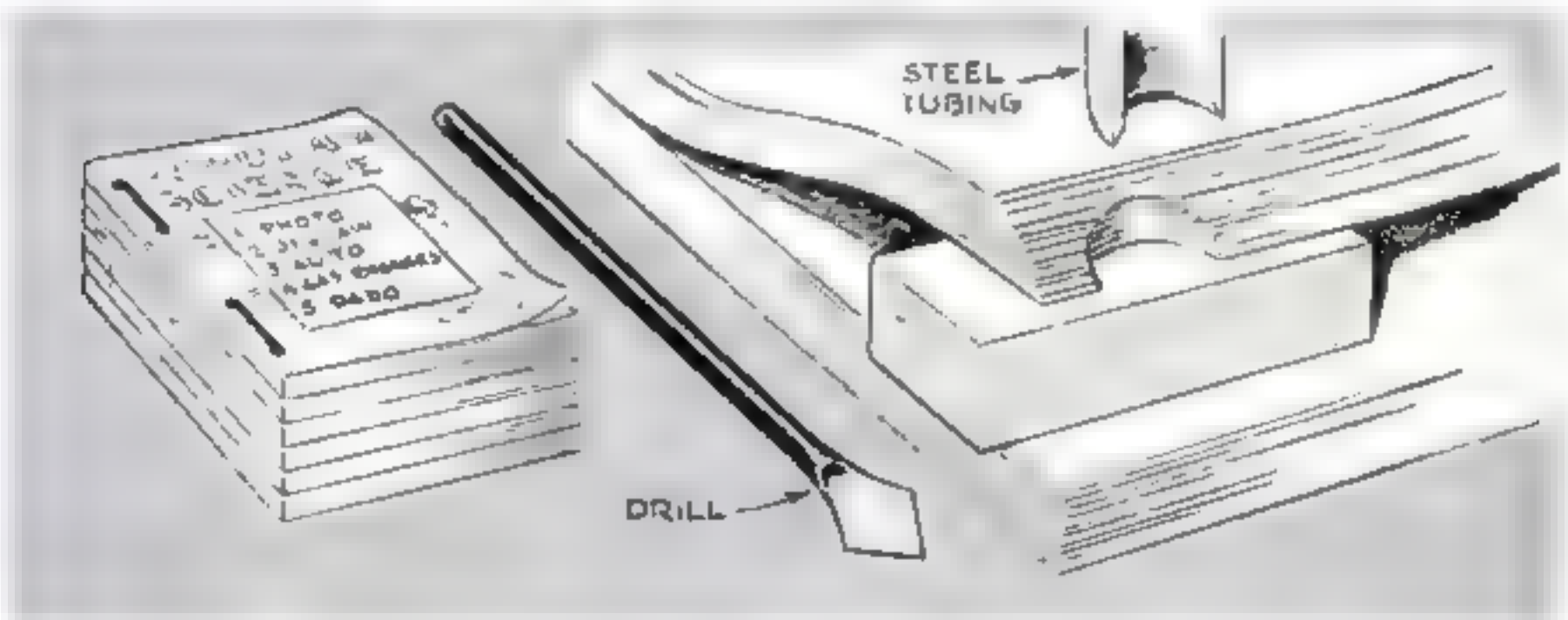
MODELING clay is indispensable for holding small or irregular-shaped objects for soldering. Pliable in your fingers, it conforms to any outline in clamping the work, is heavy enough for a good base and doesn't conduct heat. But don't let it touch the tip of the iron; it will stain.—*M. Robert Beasley, Jackson, Mich.*

Cornice Slips Off for Cleaning

CORNICES can be hung quickly, and just as easily removed for cleaning and the like, if you nail a small metal triangle to each top corner. The metal holds behind the window trim.—*John Mihalick, East Liverpool, Ohio.*

How to Shorten a Small Screw

IF YOU have difficulty in grinding small screws shorter, try this. Push the screw through a small piece of sheet metal and, while holding it with a screwdriver, rotate it against the wheel. —*R. J. Phillips, Uncasville, Conn.*



Easy-to-Make Binder for Keeping PS Issues

HERE is an easy way to bind back numbers of PS—a short cut on the excellent method described in July, '56.

I stack six months of issues beside a high fence on the drill press and make four holes in the stack ¼" from the back. For a bit I use a length of coat-hanger wire flattened on one end and pointed and ground for clearance. Then I thread with chalk line, using doubled bell wire as a needle, and knot it at the ends.

I index stories I want to refer to and notch the edges like a dictionary, fanning out about 150 pages so sharpened steel tubing will cut a tapered notch.—*F. Harry Louden, Sarasota, Fla.*

Now... a camera built to THE KODAK SIGNET 80

Whether you work in wood, metal, or plastic . . . skin-dive or study the stars . . . specialize in sports cars or specimen roses . . . aircraft models or model rail layouts . . . electronic experiments or action photography . . . *this Kodak Signet 80 Camera should be your teammate and companion.*

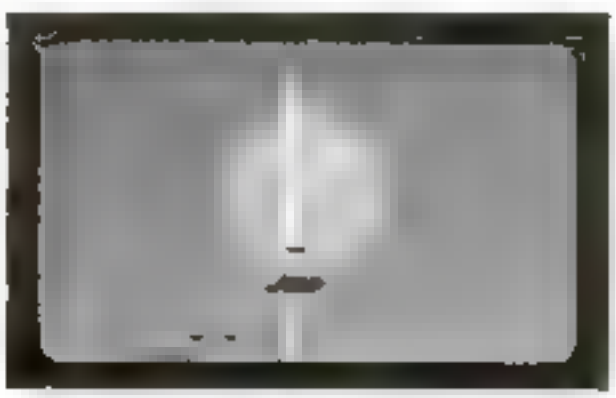
It has a part to play . . . making your hobby better—more rewarding.

Precision camera? Yes. Expert's camera? Yes—but you don't have to be an expert to operate it. Kodak, in the American tradition, has created a camera with all the features the experts demand—but easy-to-use in every feature.

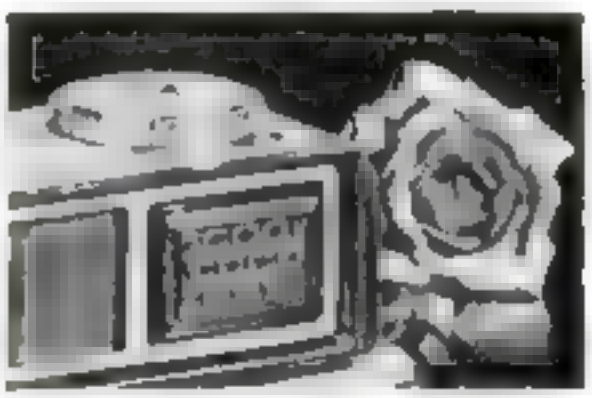
See the superb new Kodak Signet 80 Camera at your photo dealer's. Examine the interchangeable lenses. Test the photoelectric meter, the "natural-size" finder, unique new "injection" loading, the connectors for both flashbulbs *and* electronic flash. It's *the* camera to team up with your hobby. Yours for only $129.50, with 50mm *f*/2.8 lens—or as little as $12.95 down.

Here are a few ways the Signet 80 Camera can make any hobby richer, more rewarding . . .

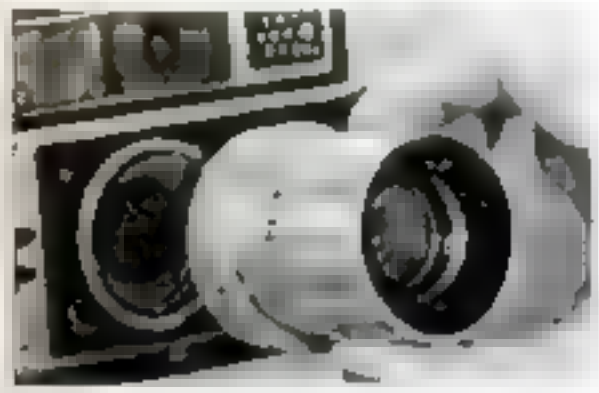
You get needle-sharp pictures with the coupled rangefinder—2½ feet to infinity! Couples to all lenses



You shoot exactly what you see, with the brilliant big-as-life viewfinder. Image is life-size!

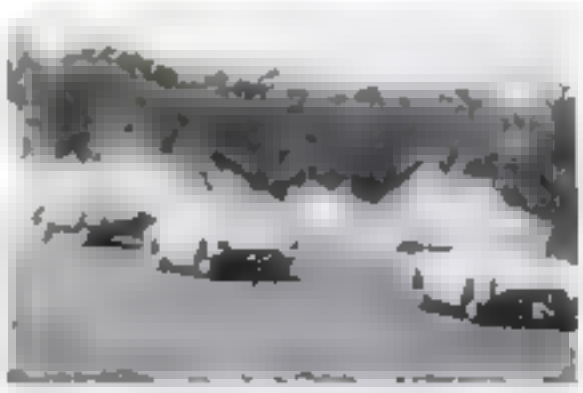


You read exposure easily—with ultra-sensitive photoelectric meter! Sets for all films.



You change lenses instantly—switch to wide-angle or telephoto. Just drop in, start shooting!

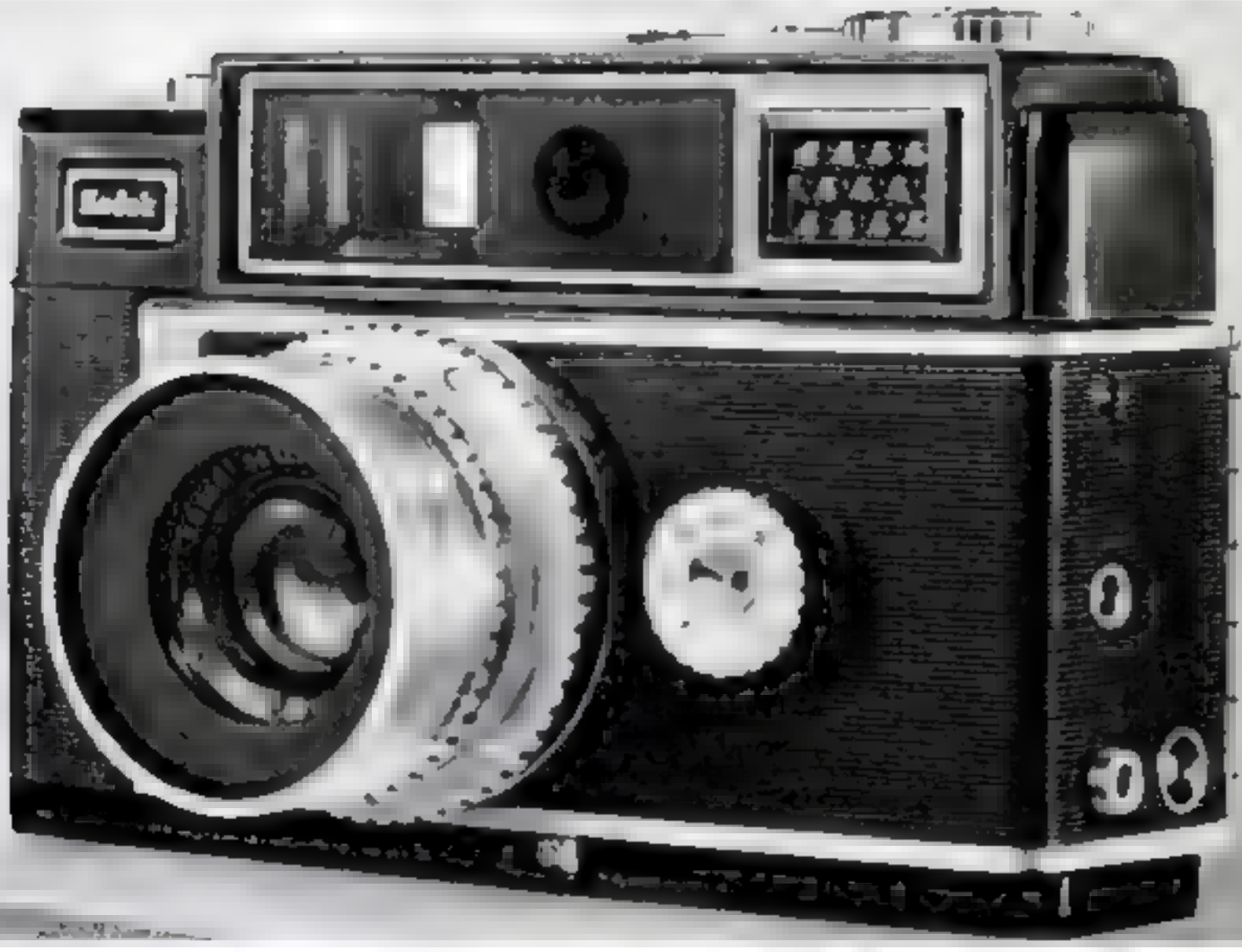
You pull in faraway scenes, take candid portraits with the telephoto lens. (90mm *f*/4, $69.50)



You capture the broad sweep of a scene with the wide-angle lens. (35mm *f*/3.5, $57.50)

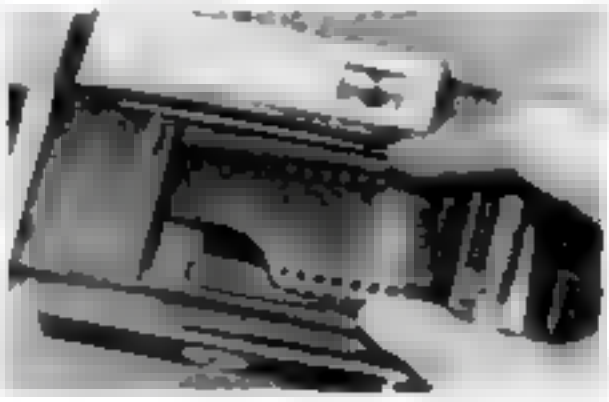
EASTMAN KODAK COMPANY •

team up with your hobby...



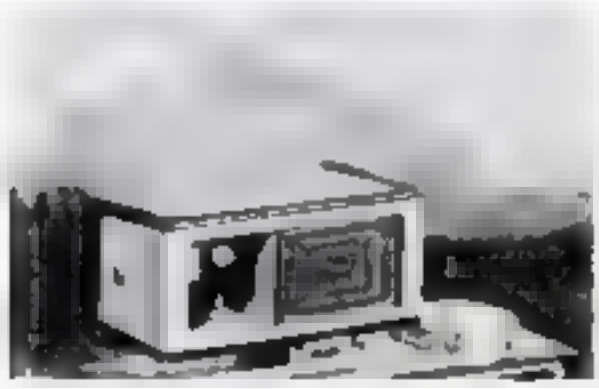
Want to shoot the moon? To team up your new Signet 80 with a telescope, write our Sales Service Division for "Telescope Pictures With Your Camera," Pamphlet C-20.

Near or far, you capture extra detail with Signet 80 rare-element-glass lenses. Superb for color.



You load film fast—drop it in, close the camera. You can do it with one hand, blindfold!

You can make ultra-close-ups of specimens with low-cost Kodak Portra Lenses. Quick, easy.



Multi-Frame Finder tells instantly which lens fits the scene best. ($17.50)

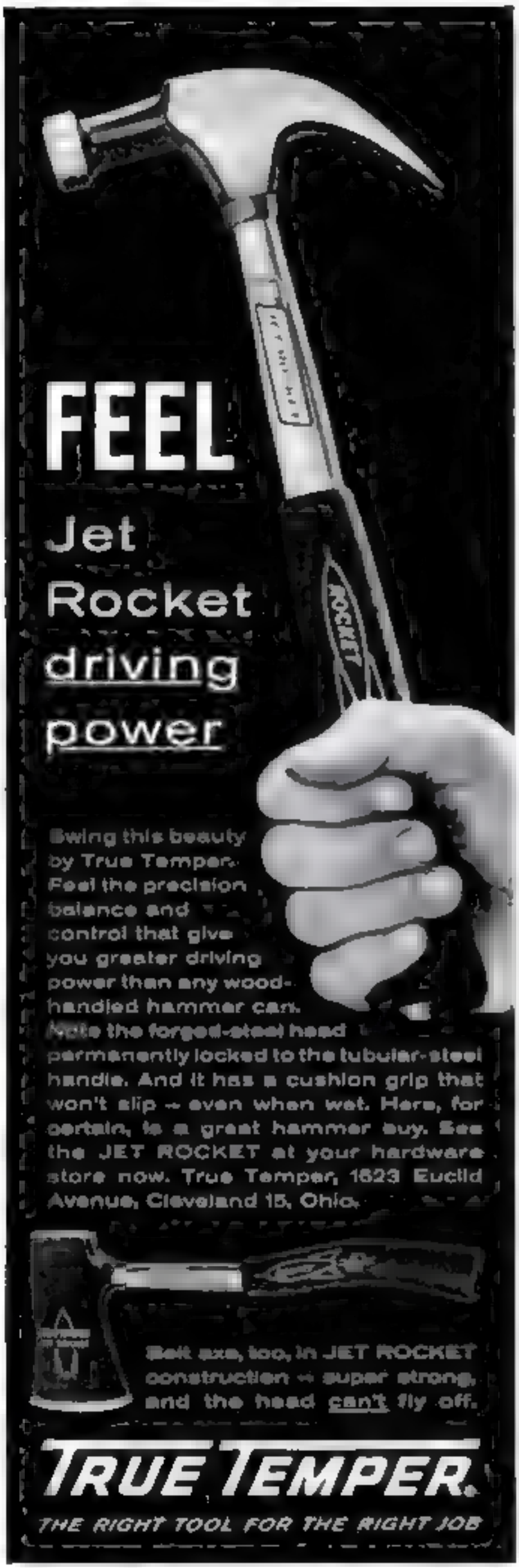
You click off rapid-sequence shots with thumb-action film advance. Sets shutter too, counts shots.

See Kodak's "The Ed Sullivan Show" and "The Adventures of Ozzie and Harriet"

(Prices are list, include Federal Tax, are subject to change without notice)

Kodak TRADEMARK

Rochester 4, N.Y.



America's Supersonic Cargo Rocket

[Continued from page 117]

gency supplies to isolated troops in seconds, Lobbers might be used to lay heavy smoke screens, send up huge flares to illuminate battlefields, hurl napalm, pay out wire for field telephones, drop radio receiver-transmitters ahead of fast-moving forces, or deliver high-explosive or nuclear warheads.

Convair engineers see the Lobber as the first of a family of ballistic cargo missiles, growing in size, range, and number of uses. They envision big, automatically piloted, boost-glide missiles for delivering fuel to stranded tanks, or replenishing heavy munition stores during a swift advance, or even, in vehicles of slower acceleration, transporting troops.

Peaceful versions of these ballistic missiles could be used to lob chemical or water bombs at forest fires, toss rescue lines to wrecked ships, or even deliver mail and express packages across the nation or oceans, the engineers say. END

Starter sends drone on way

To TURN over the engines of radio-controlled aerial targets for takeoff, mechanics roll up battery-operated motor starters like this one. The pilotless planes —12-foot "clay pigeons" for AA gunners —carry a 72-hp., two-cylinder engine, giving a top speed of 220 m.p.h.

"MEN WHO DO-IT-YOURSELF"

YOUR SKILLS CAN MEAN AN IMPORTANT FUTURE IN THE NEW AGE OF SPACE

If you like to build transmitters...or hot rods...or models...you can also build a real future for yourself by training in the U.S. Air Force. For in today's new Age of Space, it is the man with technical ability who will be the important man. *Only in the Air Force*, however, will you find so broad and complete a range of Space Age specialty training. In the Air Force, *the Age of Space* is now. For full details on your training opportunities see your local Air Force Recruiter now, or mail the coupon.

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PASTE COUPON ON POSTAL CARD AND MAIL TO:

Airman Information, Dept. MPS-94
Box 7608, Washington 4, D. C.

Please send me information on my opportunities in the U. S. Air Force. I am between the ages of 17-34 and reside in the U. S. A. or possessions.

Name _____

Address _____

City _____ Zone ____ State _____

Little Car with Big Ideas

[*Continued from page 123*]

the workmanship. It's excellent. But among good features there are some flaws. The safety factor provided by the recessed steering wheel, for instance, is offset by protruding dash knobs. And why, when you have to turn a car over to parking-lot jockeys, aren't these plainly marked? Also, in a car of this quality, why only one door that locks with a key?

On the Touring Sport, holding down the wheel button blinks the high-beam lights—a useful passing signal. But the front-window cranks seem designed for contortionists. You have to turn them with your far hand, not the nearer one.

The rear seat, as in many European cars, seems planned for in-laws only. Narrowed down by armrests, its usable width is 49 inches. Knee room depends on front-seat riders; in the Touring Sport it shrinks to six inches if they need maximum leg room—which few will.

Rear windows, hinged at the front, have a toggle latch you can work with two fingers. It locks in the over-center position, or holds the glass open at various outward angles. One fault: crunchy-munchy noises as it swings past hold-open serrations. Silent amenities include two ashtrays, grab straps and coat hooks nicely designed into the strap mounts.

The car heater is a dual system, with two heat exchangers—one for each side of the car—and dual controls. But only the costlier Touring Sport has an electric blower to urge the tepid air into the car, and even with that the system is hardly up to warming the car on a frigid day.

The station wagon, no longer than the sedans, has the same excellent interior finish together with generous glass areas and load capacity. The Coupe, at $3,750, sports a different instrument panel with a padded dash and keyboard switches marked by picture symbols. Only 52 inches high, it has a well-designed hard top with a wraparound rear window. Door cappings and interior window surrounds are of simulated wood veneer. As usual in European sports models, the rear seat is for luggage, a dog, or preschool children.—*Harry Walton.*

SHOPMATE®

Radial Saw

WITH PATTERNMAKER PRECISION AND "DUAL PORTABILITY"

FIRST RADIAL SAW WITH DUAL PORTABILITY EVER OFFERED AT THIS LOW PRICE!

Shopmate—all the accuracy and twice the versatility of other radial arm saws. A rugged, big capacity precision instrument that produces an endless variety of professional quality work!

Powerful 1 hp automatic safety clutch saw makes all cuts easily: cross cuts, dados, rips, mitres, bevels, cove cuts, etc. Widely spaced ball bearing carriage, heavy-duty ¾" Acme elevating screw, heavy steel U-beam base, treated hardwood table, precision calibrated scale adjustments with positive indent stops 45° left and right, anti-kickback in front of blade, finger-tip power control, 8-second blade coast-down, full 180° swing, and many other features.

At hardware and building supply dealers or write PORTABLE ELECTRIC TOOLS, INC. 320 WEST 83rd STREET, CHICAGO 20, ILLINOIS

USE AS A PORTABLE SAW . . . 7" saw detaches in 5 seconds.

ON A RADIAL SAW makes every cut!

Shopmate JOB TESTED

SAVE OVER $100

$149.75

SUGGESTED RETAIL

MAIL THIS COUPON FOR INFORMATION ON THE SHOPMATE RADIAL SAW!

Name_____

Address_____

City_____ State_____

How to wring more mileage from every drop of gasoline

1 Keep your carburetor air cleaner thoroughly clean or replace it regularly. Dirt chokes airflow and wastes fuel.

2 Clean accumulated dirt, oil and mud from your fan blades (or have your Texaco Dealer do it).

3 Accelerate gently. "Jackrabbit" starts use up to 60% more gasoline.

4 Reduce engine friction by having your crankcase drained and refilled with the motor oil that lubricates ideally in every season . . . all-temperature Havoline Special 10W-30! Get maximum protection against cold start wear, hot running wear, and power-robbing sludge and deposits.

5 Maintain a steady, light foot on your gas pedal, and allow engine compression to slow you down instead of braking hard.

6 Turn off ignition when you stop for more than a minute. Takes less gas to restart than idling for 45 seconds!

7 Make sure tire pressure is correct.

8 Keep your tank filled with *the* gasolines blended for top performance and economy . . . Texaco. Both Sky Chief Su-preme and *regular price* Fire Chief are 100% Climate-Controlled for every one of 26 climate areas in the U. S.

THE TEXAS COMPANY

TEXACO

Buy the best . . . buy TEXACO

Russia's Small Cars

[Continued from page 139]

port trade in mind). They are bound in hard covers, and are about the shape of a city telephone directory. The information in them is exhaustive.

The sleek but rather sluggish Volga has an electric clock, cigarette lighter, ashtray, tubeless tires, pushbutton tuning on its radio, plunger locks on its doors, and a pedal, to the left of the clutch, that works a chassis-lubricating pump.

Next Month: U. S. cars often change so much, year to year, you need the nameplates to identify them. Not so, the imports. But there are subtle changes. Find out what's new with VW, Renault, Hillman, Opel, Vauxhall, Fiat, Simca and such—in May PS.

Speaking of clutches, I found them too close to the brake pedals in both cars. The soles of my shoes kept tripping on each other as I drove. And the brakes, though hydraulic, seemed awfully reluctant to take hold.

Gas mileage: 33½. On the word of its English manual, the Moskvitch can go 65 m.p.h., with four people aboard, "on a horizontal section of smooth road in summer time." Maybe so, but in winter, alone and plagued by hills, I couldn't do anywhere near as well with it. However, the manual says it goes 33½ miles on a gallon of gasoline "at speeds of 18-25 miles per hour over a level road section." I don't doubt it.

The Volga's manual estimated its top speed at 84 m.p.h. and its best fuel consumption at 25 m.p.g.

My feelings about the Moskvitch admittedly are colored by the fact that it died on me at a crowded street corner, just ahead of an impatient bus. I then had to push it across one of Hollywood's busiest intersections to a filling station. The proprietor, a local Gus Wilson who acted as if Russian cars limped onto the premises every other hour, fished around under the unfamiliar hood for a few minutes and then found a loose connection. In an instant, the impish Moskvitch was whirring again like a well-oiled sewing machine.

I will say this for it: It idles nicely. —*Wesley S. Griswold.*

new PERMA-GRIT* hand sander cuts sanding time in half...

A wonderful, new workshop abrasive. Sands twice as fast as old-fashioned sandpaper. Can't be beat for removing old paint or enamel or for sanding wood, plastics, dry-wall, compositions.

Outlasts hundreds of sandpaper sheets—Made with tungsten carbide particles permanently bonded to steel. Always stays sharp and ready to use any time.

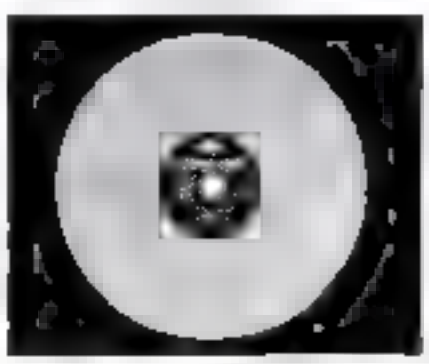
Deluxe Hand Sander Kit—Hand sander comes with two sanding sheets, one fine and one medium-coarse, at $2.95. Sander with choice of either sheet, only $1.95. Try a free demonstration at your local hardware, paint or lumber store.

*A Trade Mark of SKIL Corporation

PERMA-GRIT FILES ..... **PLANE** ..... **WHEEL**

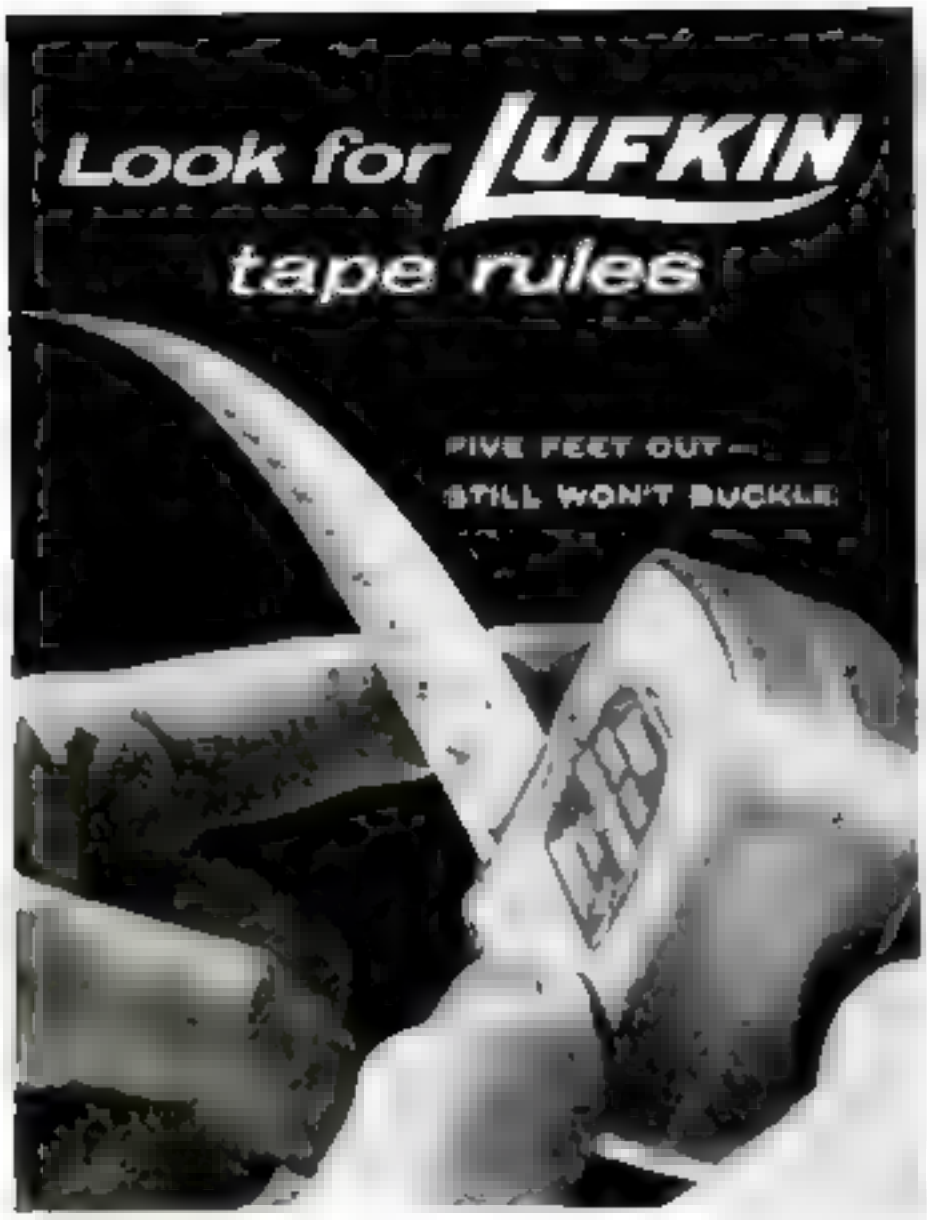
Flat or curved file, twice as fast

Files, sands, planes, shapes or notches



Safe wheels for table or portable saws

Made only by SKIL Corporation, manufacturer of famous SKIL and SKILSAW products, 5035 Elston Avenue, Chicago 30, Ill.



¾" SUPER MEZURALL

In the photo above, five feet of the steel blade are extended, yet the blade hasn't buckled.

And look at all these other features!

- Easy-to-read, black markings
- Shows both total inches — and feet and inches
- Self-adjusting hook, 2" case for inside measuring
- Blades quickly, easily replaced

Lufkin White Clad® Mezurall tape rules are available in both Regular ½" and Super ¾" widths, with 6', 8', 10' and 12' lengths.

You'll find a world of Lufkin measuring tools at your hardware store.

LUFKIN TAPE RULES

TAPES RULES PRECISION TOOLS

[*Continued from page 84*]

ment capable of relaying TV signals will be sent up. Its special path will keep it always over one spot on earth (probably mid-Atlantic). Rocketdyne already has an order for the giant engine needed to launch it—a cluster of eight rockets generating 1,500,000 pounds of thrust.

While these are all Government plans, commercial companies in the overseas communications business—RCA, Bell Telephone and International Telephone—are on the ball, too. RCA, which is building the black boxes for the Signal Corps' tests, worked out the satellite post-office scheme. Most published details on the use of plastic balloons for relaying TV come from one of Bell's top scientists, Dr. John R. Pierce (they represent his personal ideas, not Bell's).

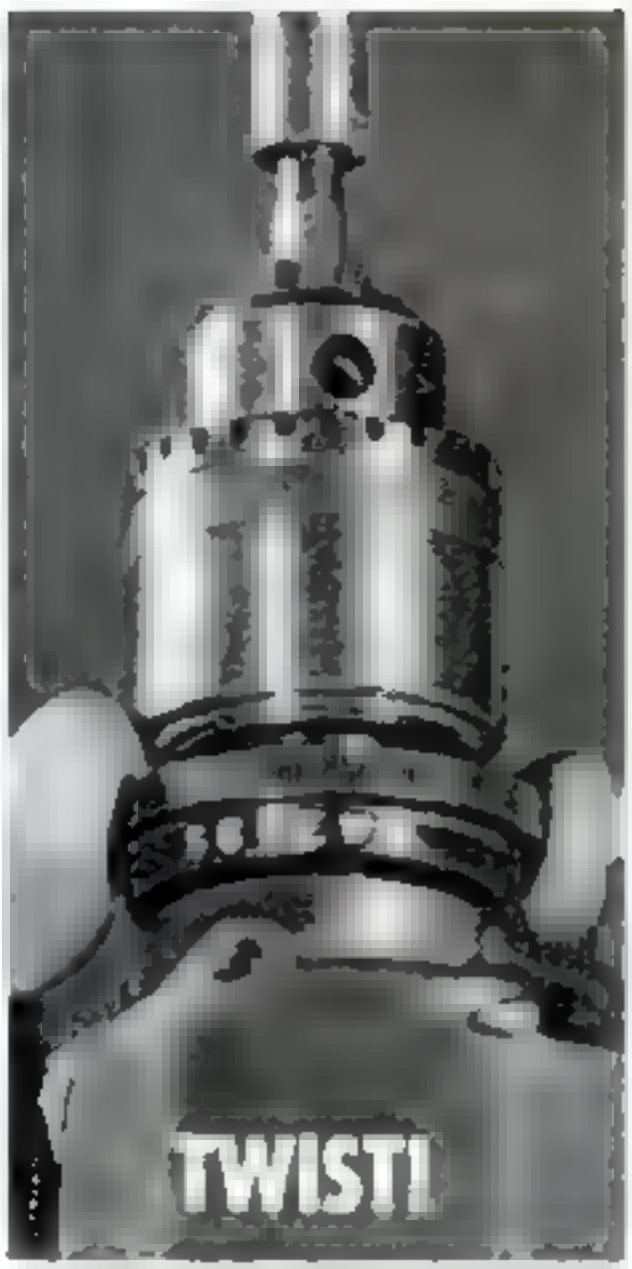
Where private firms would get their satellites is apparently unsettled yet. (Rent from the Government? Buy their own rockets?)

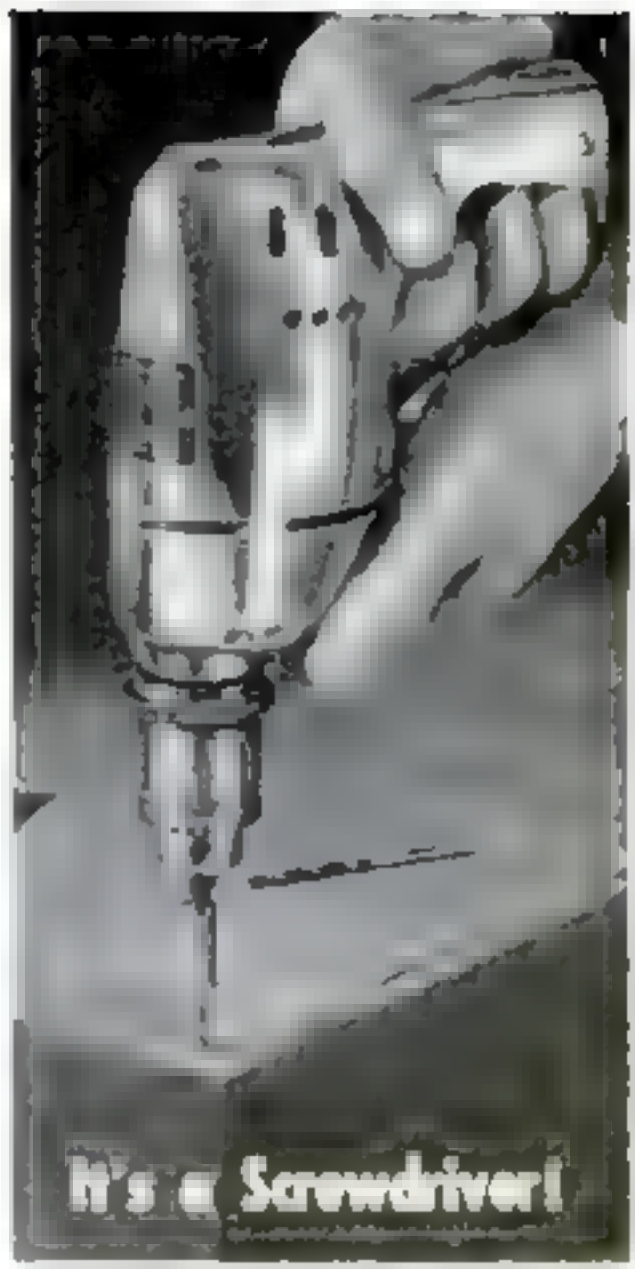
Why satellites? Simply because they can do a communications job that can't be done any other way.

Transatlantic TV is impossible now. The TV wave contains too much information to squeeze through existing cables. To go through the air, it has to ride very short waves—and they travel in straight lines, like light, as far as the horizon and then off into space.

This is where the satellites come in. They can bounce the short waves back to earth, acting as relay stations in space. So they will make it possible to transmit such waves across oceans. These waves can carry great loads of information—TV shows, or vast numbers of telephone conversations and telegraph messages simultaneously. The military services, particularly, need more communications channels than present radio and cable circuits now offer.

And it's cheap. Comparatively, that is. The cost of orbiting several satellites for a good communications relay—able to handle 1,000 telephone conversations and several TV channels all at one time—will be around $100,000,000. If that sounds like a lot of dough, remember that the recently completed transatlantic telephone cable—which carries fewer than 100 phone conversations and nothing else—ran to about $40,000,000. END





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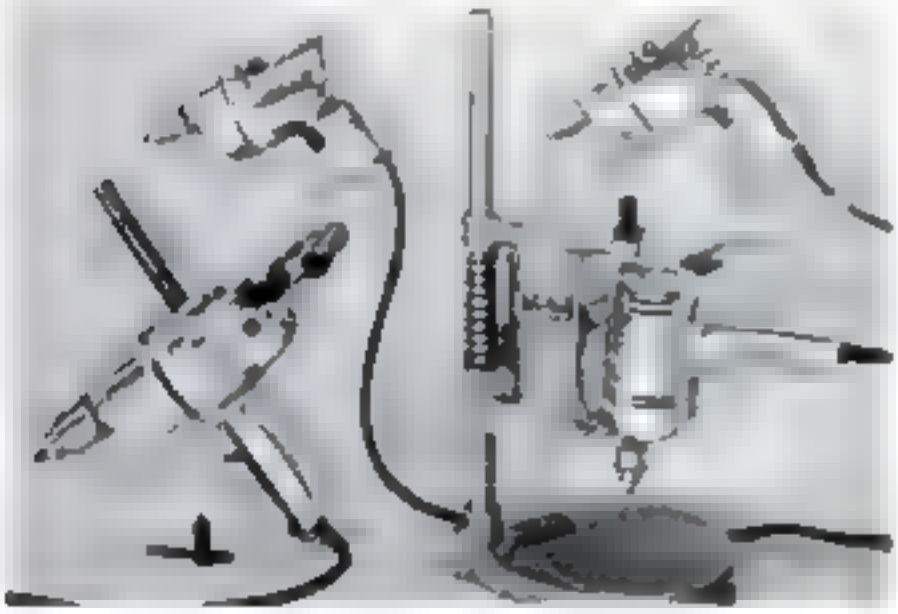

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049 Use margin for more writing space.

5 Ways to Lick That Tired Feeling

[*Continued from page 134*]

Fear of actual danger is rare in ordinary life. But anxiety is very common. Here again, a feeling says, "Something must be done." But when the action is one you cannot take without seeming to step out of line, nervous fatigue takes over.

In the Navy study, Dr. Shands and Dr. Finesinger found that nervous fatigue often follows change—a new job, a marriage, the birth of a child. These events demand behavior that seems out of character with the persons we've always thought of ourselves as being. Fatigue is a way of avoiding the readjustment.

One clue for recognizing nervous fatigue is its association with certain occasions.

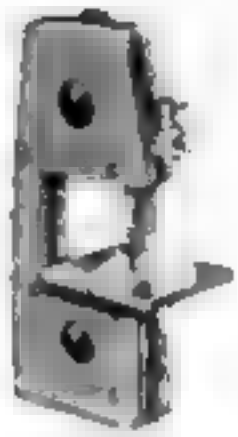
One doctor told me of a high-powered executive who went into a slump on Tuesdays and Thursdays. Those were the days for staff meetings presided over by his father-in-law, whom he hoped to replace. The patient confessed he had secretly "hoped the old man would kick off." It was to duck guilty thoughts like this that he became "so tired I can't think straight." When he faced his feelings, they no longer incapacitated him.

How to stay peppy

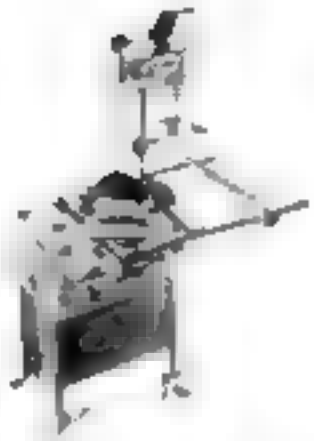
Whatever the cause of fatigue—actual physical exertion or mental stress—you can often get around it. Research at many laboratories has pinned down practical methods you can use to work and play harder and feel less tired. Here are five:

1. Check your health. To generate energy for a full life, you should be in top physical shape. Just knowing that you are gives you a boost. Since you use vision and hearing more than any other senses, be sure you have no hidden eye or ear defects.

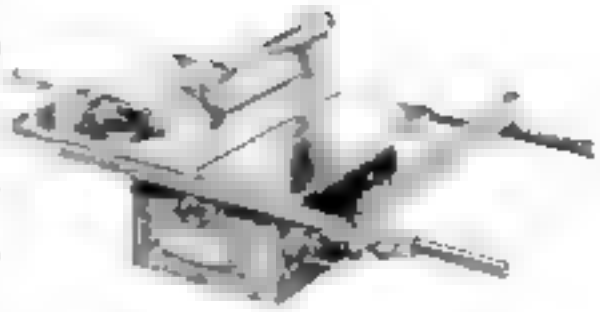
2. Check your posture and appearance. Try this quick experiment: Slump in your chair and let your head droop. Notice how lethargic you feel. Now straighten your back, hold your head erect and square your shoulders. The lethargy disappears. The same thing happens when you spruce up with a shave and fresh suit. It's like driving a newly polished car. Psychologists explain that you impress yourself with good grooming,



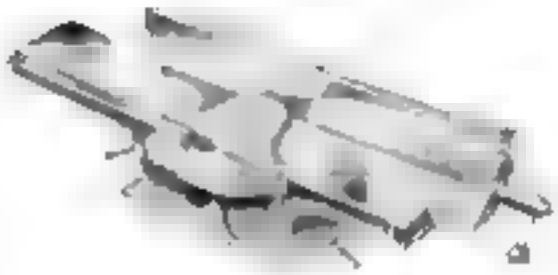
10" Band Saw



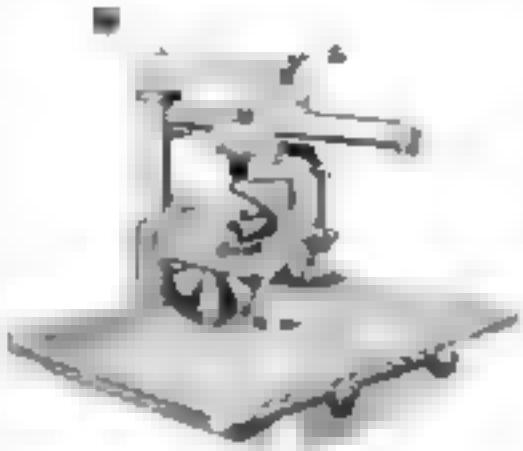
Delta Shop—combines Saw, Jointer, Drill Press, Sander.



9" Tilting Arbor Circular Saw



Deluxe 4" Jointer



"Super 900" Radial Saw

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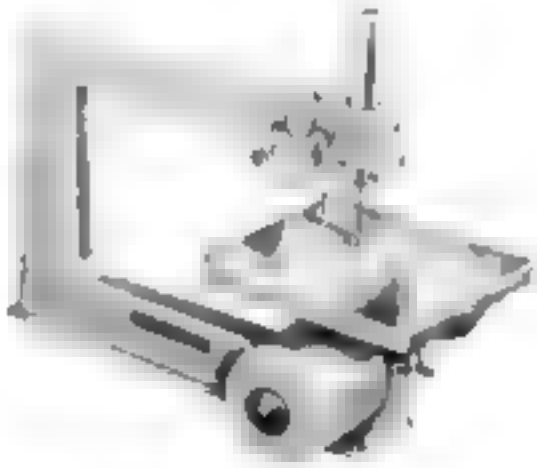

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you feel and act the way you look. Your voice also affects your pep: Clear, firm speech helps ready you for action.

3. *Check your attitudes.* At the University of Cincinnati, Dr. Arthur G. Bills blindfolded a coed and a football player and asked them to stand as long as they could with outstretched arms. The football player tired and dropped his arms after 10 minutes. The coed continued with no sign of strain. Before the experiment

Next Month: Can you trick the roving eye of the highway police radarscope? Lots of motorists have tried—and some of their devices are worthy of an Edison. Only trouble: They don't work. Read "Why You Can't Fool the Cops' Radar" in May Popular Science.

she had been told that the task was easy. The football player had been given the impression that nobody could endure this test for more than a few minutes.

"Most of the suggestions that make you feel peppy or tired come from within," says Dr. Bills. "By weeding out negative ideas you can work and play harder."

Some attitudes that make you tired: "I am unlucky." "Other people are so much smarter and better educated than I am." "The harder I try, the worse I do." "People don't like me."

4. *Program your day.* You'll concentrate better—with great savings in energy—if you plan what you have to do and when. Notes on a calendar pad are enough. But make your program flexible and varied—boredom tires you, too.

5. *Define your goals.* A sense of achievement erases tiredness. So mark your aims clearly. Psychologists advise four kinds of goals:

- The immediate goal of finishing the task at hand.
- The intermediate goal of gaining skill and experience for advancement.
- The ultimate goal of success in your field.
- An ideal goal that transcends personal ambition and gives meaning to your life.

Yet the most effective weapon against tiredness is the simplest: your sense of humor. One doctor says: "If you can't sleep off your fatigue, laugh it off." END

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Stupid Traffic Rules
[Continued from page 146]

local drivers passing you at 45 m.p.h. and seeming to be quite safe. Sometimes you even know you're delaying traffic by obeying the law—and anyone who blocks the normal flow of traffic is himself a hazard.

What to do?

Bill and I finally agreed: since speed laws *never* mean exactly what they say, most police now give you a "tolerance" of a few m.p.h.—if you drive carefully. Thus, 30 m.p.h. is now beginning to mean to most drivers and police, "30-mile *range*"—i.e., 30 to 38 m.p.h. And 50 m.p.h. often means "50-mile *range*," or, say, 50 to 58 m.p.h.

Most motorists, knowing this, abide quite well by this understanding of the law. They would do better, we agreed, if when a speed limit that seems low is posted, it were accompanied by signs explaining the reason.

Back in New York State, we had seen one quiet suburban road posted, without explanation, for 35 m.p.h. Result: You felt tempted to drive 50, which seemed safe. Near Paoli, Pa., we had seen another quiet road posted for 35. But here, in addition, was a big sign saying, "WATCH CHILDREN." Given the reason, you respected the law and complied.

The incredible light on Route 40. But none of the hazards and annoyances we had found so far could compare with a traffic signal we came to near Wilmington on Route 40.

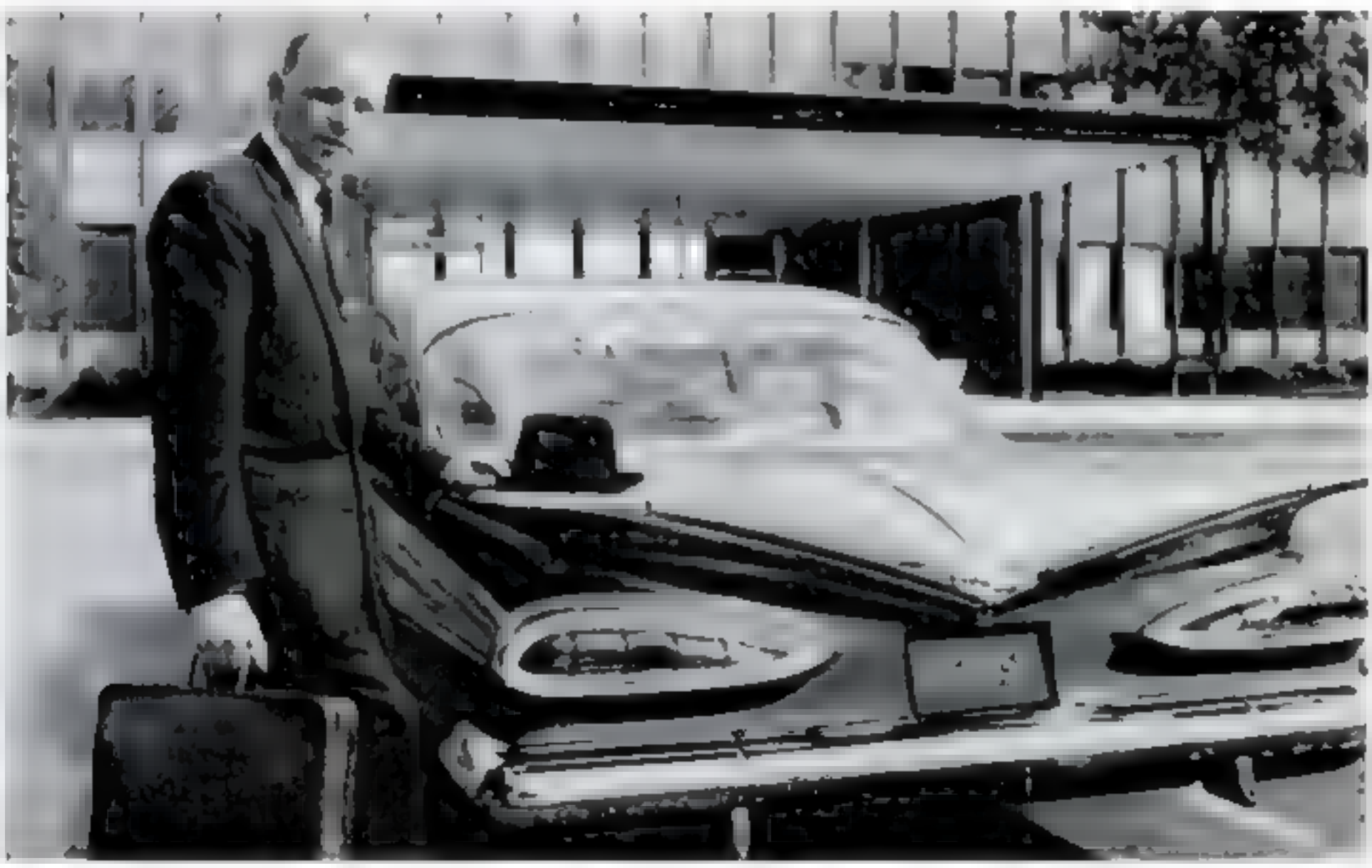
The speed limit here is 55 m.p.h. Traffic: heavy, with many huge trucks, and rolling fast. A half-mile ahead, we saw the traffic signal for Route 7, a small Delaware road. As we approached, the light turned yellow, then red. We slowed down a bit to use up time, and when the light turned green we stepped on it, and so did a dozen other cars and trucks. Then, to our amazement, the light suddenly went red again.

We hit our brakes. Several cars slid to a skidding stop. A truck driver did a beautiful job of getting his rig under control in time. We all made it, to the tune of a few tire howls.

When the light turned green once more, we went on. But in our mirrors we saw, after a few seconds of green, the light *again* turn red, having stopped

What kind of a car do you want, exactly? Chevrolet has a choice of nine engines, five transmissions, two suspension systems, regular or Positraction rear axles, special cams, two air-conditioning systems, even Fuel Injection—the list of extra-cost options is tremendous. But what it means is that you can virtually design your own car, tailored precisely to your needs. Here's just one example:

"I 'built' my Chevy for top economy... and extra easy running at 300 miles a day."



"As a traveling salesman with a big Midwest territory I rack off about 300 miles a day—and, boy, how I love gas economy. But I like all the comfort I can get, too.

"I used to wish I could design my own car, until this year. That's when my on-the-ball dealer friend showed me how I could 'build' just the right car out of Chevy's terrific list of options. Look what I got:

"I picked a Biscayne two-door, 'cause I pay for my own auto and that's right at the base of the price list. A Hi-Thrift 6 engine—that's the world's best workhorse. And Overdrive; with that high ratio you can just whisper down the road at good fast cruising speeds. No strain, hour after hour . . . and that gas needle *never* seems to go down!

"Then I pampered myself a little bit. Foam rubber padding in the seats (I'm a big guy and I spend *hours* at the wheel); Chevy's new throttle-holder where you just set your cruising speed for those long straights and the car holds it while you rest your right foot; the big 'fresh-air' heater. Man, you should drive my car. It fits me like a glove!"

There's something to figure on, friends. Whatever kind of car you want—sports car, salesman's car, town car—you can "design" it for yourself. But check your Chevrolet dealer and see how you can suit yourself to a T. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

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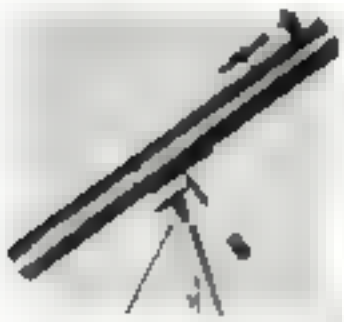

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mile-a-minute traffic three times within 90 seconds! We couldn't believe it.

Invitation to a bump. For the next hour we watched that incredible light. Now and then, a car or two did come out of Route 7. But, religiously, at least once and often twice a minute, the light turned red. Surprised drivers squealed to a stop, cars humping in protest.

We timed the light, but couldn't figure it out. Sometimes it changed to red after 30 seconds, sometimes after 50 seconds. The whole rhythm was complicated by a treadle control in the side road. Any car approaching Route 40 could trip the treadle and take control. The treadles were so close to Route 40 that they did not "collect" cars at all—but stopped Route 40 traffic for all comers—willy-nilly.

Importance of timing. In Washington, I interviewed another champion of the driver, engineer Burton Marsh of the American Automobile Association.

Marsh told the reason for those short amber lights: If they run longer than five seconds, drivers tend to run through them. But he also told how one city has coped with this: Pittsburgh's lights turn from green to "green-amber." (Both green and amber show for a few seconds.) *This warns you!* Then the amber shines alone for a few seconds and you stop easily.

Marsh, like Yale's Director Hurd, told me that many of our highly competent engineers *know* our road perils but often are blocked by lack of funds. Many such perils, Hurd said, are inherited from earlier days.

Nevertheless, we are still plagued by untrained traffic crews—and official blindness. One engineer not long ago pleaded for signs three feet high on one fast route. But a highway commissioner pooh-poohed the request saying, "Any driver who can't read our *one-foot* signs shouldn't be allowed on the road." He'd missed the whole point: at 60 m.p.h. today *nobody* can see a one-foot sign in time to act without imperiling other cars.

Meanwhile, with our new turnpikes we're getting there. BIG, clear signs; wide lanes; no left turns and no crossovers—these make travel safe and let drivers show what they can do, given *intelligent* instructions.

But we still have a long way to go. END

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[*Continued from page 166*]

with ¼-hp. compressors." A typical gun in this class may use as little as one cubic foot of air per minute at 20 to 25 pounds' pressure.

Which gun for what job? Six basic features determine what a spray gun can do: two different methods of feeding paint to the nozzle, two different methods of breaking it into a spray at the nozzle, and two different types of trigger control.

You can't have all these on the same gun at once, but for as little as $20 you can have two guns that cover the entire group or one convertible gun that can combine the various features as needed. Here's how they work:

Suction-feed guns draw paint up to the nozzle by blasting a stream of air across the top of the tube that leads down into the container. This creates a partial vacuum that "sucks" out the paint the way an atomizer does. This is good with light-bodied paints, but not as good with heavy ones. It has a big advantage where frequent color changes are necessary: Stick the tube into any container, even a paper cup, and it will draw up paint.

Pressure feed. This is a more powerful system because compressed air is actually blown into the container to force paint up the tube to the nozzle. You need this for heavy-bodied materials like thick house paint, although it also works well on light-bodied finishes. A tight-fitting metal paint container is required to withstand the pressure, which means you can't switch colors as fast as with a suction-feed gun unless you buy extra containers.

Pricewise, you may find little differences between pressure-feed and suction-feed guns. Your decision here should be based on which types of paints you plan to use most: light or heavy.

Choosing the nozzle. In "external-mix" guns, the paint and air stream come together outside the nozzle, or air cap. The paint is fed out through a tiny hole in the cap, then is hit crosswise by two or more high-velocity air jets that break the paint into a fine spray. The paint feed may be by either suction or pressure.

You want external-mix if you're working with quick-drying materials such as automotive finishes because there's no chance for the dried particles to build

New Sea-Horse 5½, thermostat-controlled cooling . . . $230

How Johnson engineers cured "chills and fever" in outboard motors!

Just as our human "machinery" works best at 98.6° F., there is also an optimum temperature at which an outboard delivers top efficiency.

In gasoline engines, the temperature is usually controlled by circulating water around the cylinders. Easy enough, you'd think, in an outboard motor running in water. But the very fact that an outboard motor draws its cooling water from the water it's running in creates some special problems.

For example, lakes, rivers and oceans represent a wide range of water temperature from spring through fall. Obviously a system designed to cool a motor running at full speed in 80° summer lake water must not *over*-cool the same engine running in almost freezing water.

In 1958 when Johnson pioneered with outboarding's first "V" engine it had a new thermostat-control on the cooling system. This unit was specially designed to hold engine head temperatures at an ideal 140°. It worked so well on the Sea-Horse V-50 and 35 that for 1959 similar thermostat-controlled cooling has been built into all models down through 5½ hp. The result is smooth running performance at any speed—and in water of any temperature.

New thermostat control is just one feature of Johnson's exclusive Dynautical Design—to go better with your boat and make your boat go better. For full details see your Johnson dealer. He's listed under "Outboard Motors" in the Yellow Pages.

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JOHNSON RED HEAD PORTABLE AIR COMPRESSOR
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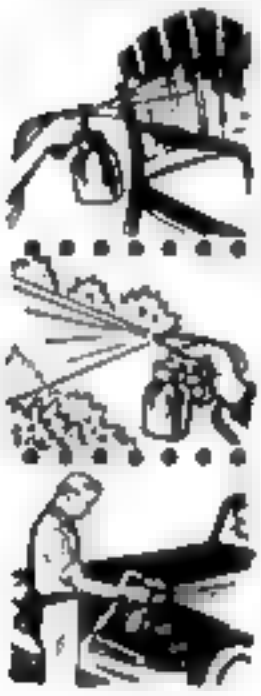
There's simply no end to the jobs you can do with this new all-purpose unit! Red Head lets you do scores of chores better, faster, easier! For example:



SPRAY PAINTING—furniture, fences, siding, screens, porches, boats. Red Head gives smooth, professional quality results, cuts painting time up to 85% or more! Easily handles heaviest multi-color paints!

GARDEN SPRAYING—spray insecticides, fungicides, weed killers. Protect roses, shrubs, flowers, vegetables. Fine mist covers all surfaces. No waste

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COMPLETE KIT includes compressor, spray gun, 15 ft. air hose, pulleys, V-belt, tire chuck and fittings. Use any ¼ hp or larger motor

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Model 105 offers the same rugged power and efficiency as the Red Head. Has built-in compact ½ hp GE electric motor. Delivers clean, oil-free air. Portable. Carry unit anywhere—weighs only 23 lbs. Sold with same complete kit as Red Head. Only $67.50 including motor

36 Other Models from $30

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up inside the nozzle and cause clogging.

In "internal-mix" nozzles, the paint and air come together inside the air cap and are jetted out a small opening. This sprays heavy-bodied materials well even at relatively low pressures. It's the type of mix you want for thick, slow-drying house paints where clogging isn't a problem. Because of its operating principle, it won't work with suction feed.

Types of triggers. You have two choices here. They have nothing to do with performance or quality, but are important to know about so you can match the right gun to the compressor you're using.

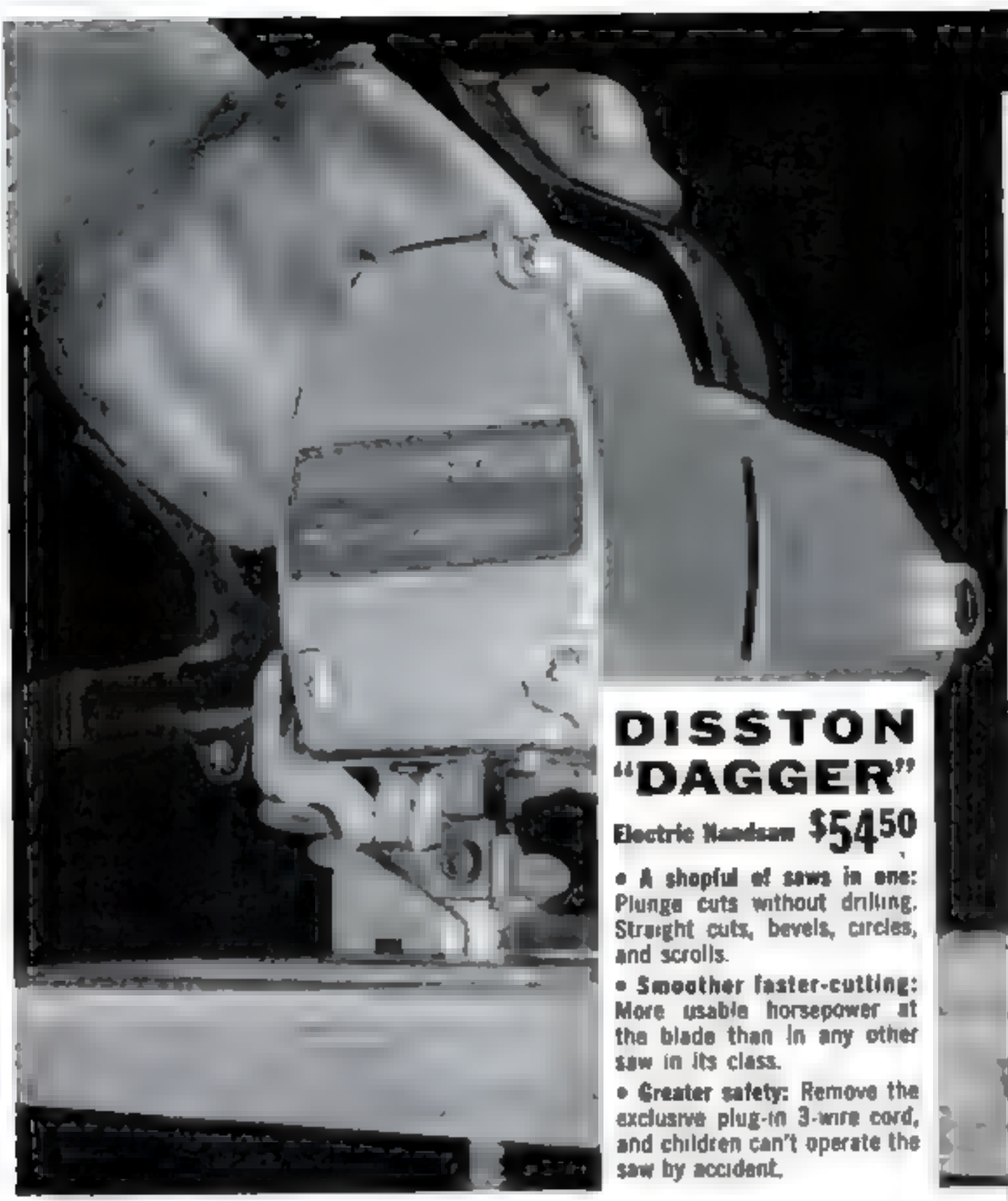
Guns known as the "bleeder" type have a trigger that shuts off only the paint, letting the air bleed through all the time the compressor is running, whether you're spraying or not. You want this kind of gun for use with the small, constant-running compressors that are the most common home-owner type. The reason: By bleeding air at all times, the gun eliminates back pressure on the compressor and possible motor overload.

"Non-bleeder guns" cut off both paint and air when the trigger is released. This is the system to use on pressure-regulated lines where the compressor builds up pressure in a storage tank, then shuts off automatically until the pressure drops below a preset level. The non-bleeder gun makes the most economical use of this kind of air supply. A bleeder type would simply waste air.

Convertible guns from about $20 up let you switch to any of these features that the job happens to require. You change air caps for internal or external mix. You add a little attachment, often a conversion paint container, for pressure feed instead of suction feed. Some convertibles switch from bleeder to non-bleeder action with the aid of a screwdriver or a three-position trigger.

Where you are likely to use a wide variety of paints or equipment, the extra cost of a convertible may well pay off.

Spray patterns. The shape of the spray you get with a gun is either round or oval. On an internal-mix gun, a round nozzle makes a round pattern; a slotted nozzle, an oval or "fan" pattern. With most guns of this type, you get both a round and slotted nozzle, and some include an angled nozzle that slants the



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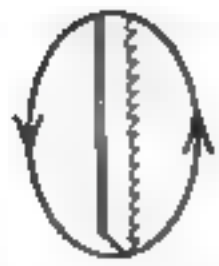
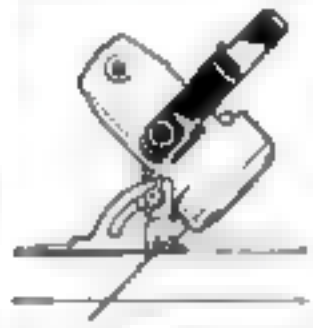


Cleaner, truer, faster cutting with exclusive Orbite action. Blade cuts going up, backs away going down.

Plunge cuts without drilling . . . makes work fast and easy on plumbing, electrical outlets and cutouts.



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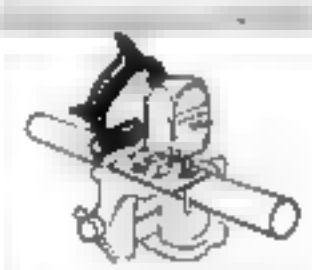

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spray 45 degrees upward so you can paint ceilings without tilting the gun. You use the oval pattern like a wide brush for large areas and the round pattern like a round sash brush for narrow surfaces.

External-mix guns form a vertical oval when the projected air jets, called "horns," are horizontal. They form a horizontal pattern when the horns are vertical. The reason: The cross streams of air tend to flatten the normally round spray pattern. In many guns you can adjust the air supply to the horns to vary the spray pattern from oval to full round.

How much pressure do you need? For heavy-bodied paints, look for a sprayer that can work at around 35 pounds' pressure to avoid excessive thinning. Paint over-thinned to spray at low pressure may require an extra coat.

Many materials, however, spray best at low pressure. Multi-color paints give their best pattern at around 12 to 18 pounds' pressure. If your unit has no pressure gauge, test-spray some samples to find the desired effect.

Excessive clouds of overspray with light-bodied materials are the tip-off to too much pressure. This wastes paint and causes it to settle on surfaces you don't want painted. END

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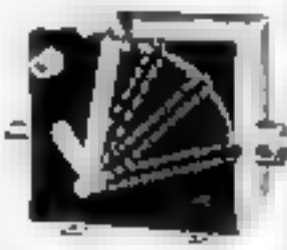

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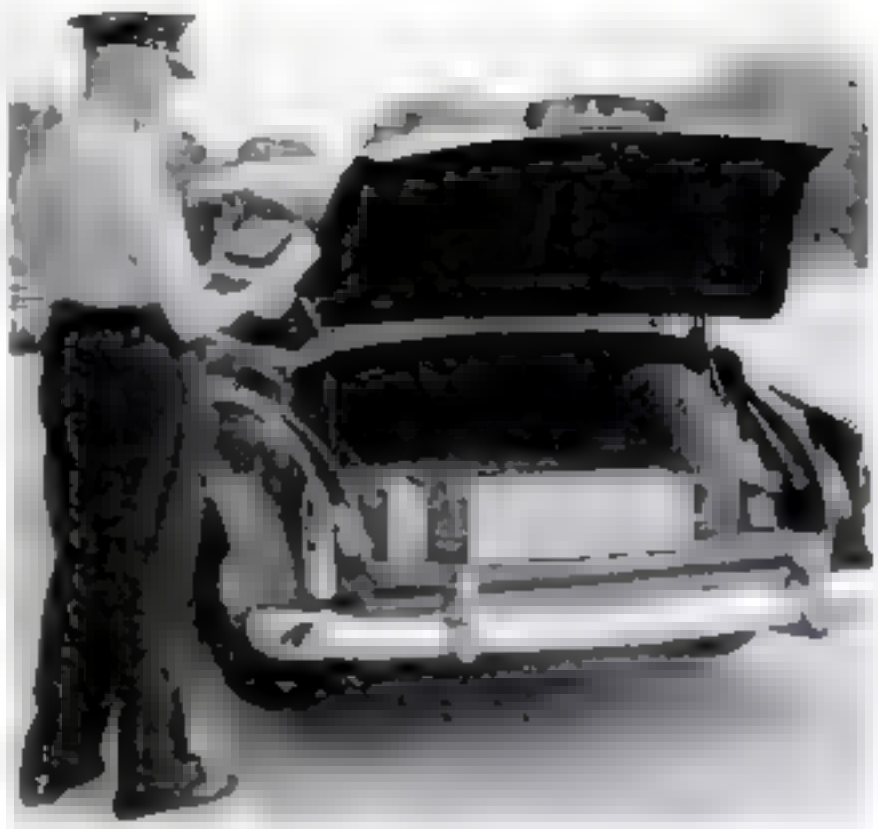

Picks speeder out of crowd

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To turn in super generator

THIS big spindle, 14½ feet in diameter, carries blades 44 inches long—largest ever used by Westinghouse in a turbine. It's for a power plant at Eddystone, Pa., making 325,000 kilowatts of electricity.

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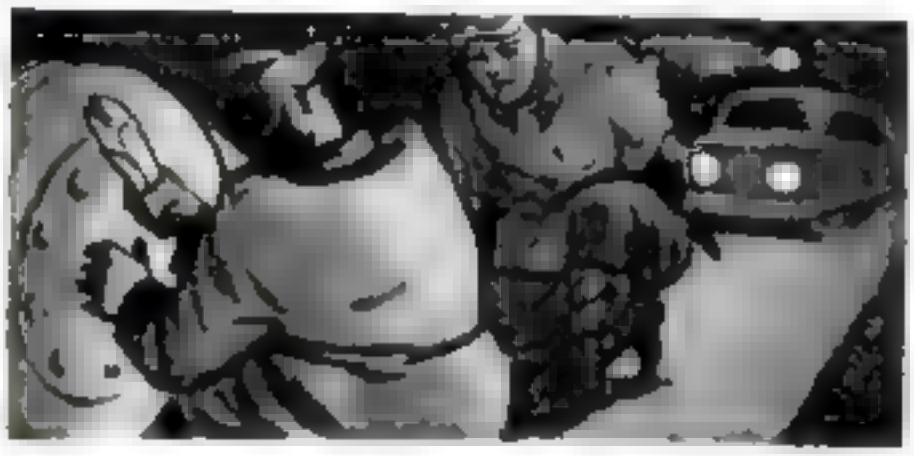

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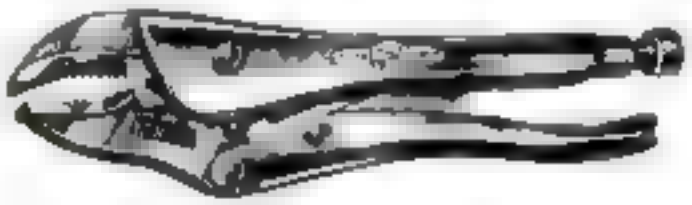

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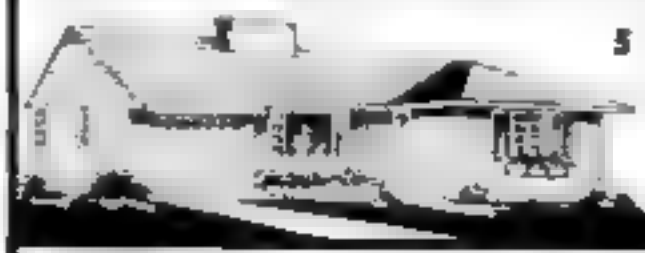

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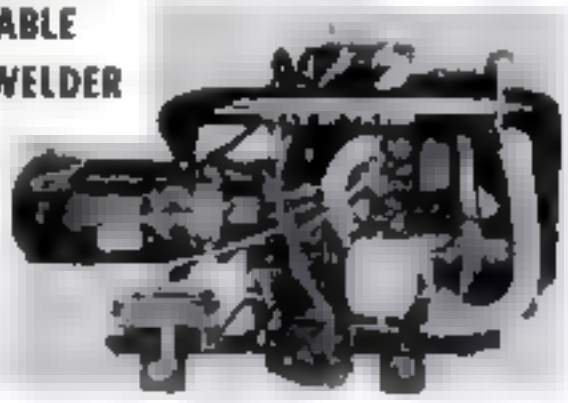
200 Amp. PORTABLE GASOLINE ENGINE WELDER

Government Cost $2,900.00

Yours $189.50



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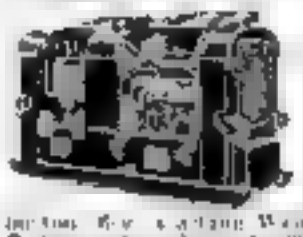

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● Item #660. Fortunate purchase allows us to again offer new condition famous M-5 power plants. Excellent for [illegible] standby or [illegible] for home, farm or [illegible]. Push [illegible] Weather proof [illegible]
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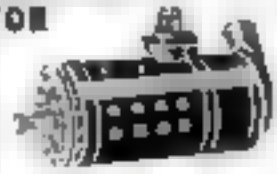

● Item #672. Famous new-condition P-1 200-250 amp aircraft generator. Thousands of these giving excellent service as welders. Other uses are DC power plant, fast battery charger [illegible] to adapt into portable welder [illegible] HP engine [illegible] drive off truck or [illegible] 250 amp 24-30 v, 2500-4500 rpm. [illegible] x 6". Wt. 48 lbs. Govt. cost $ [illegible] SALE $18.95 FOB

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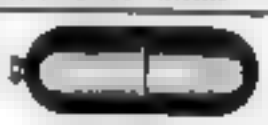

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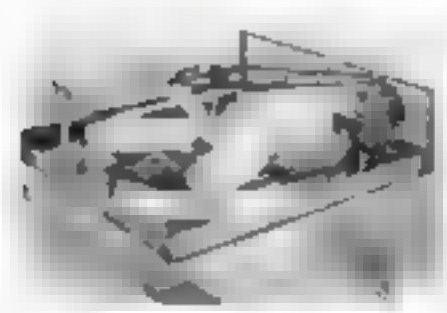

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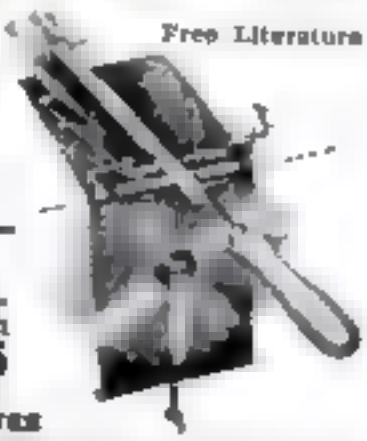

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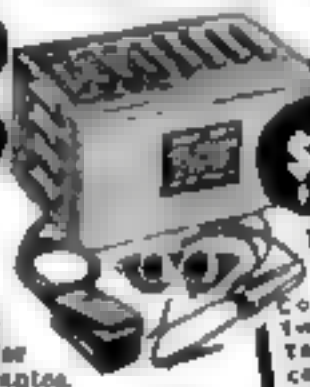

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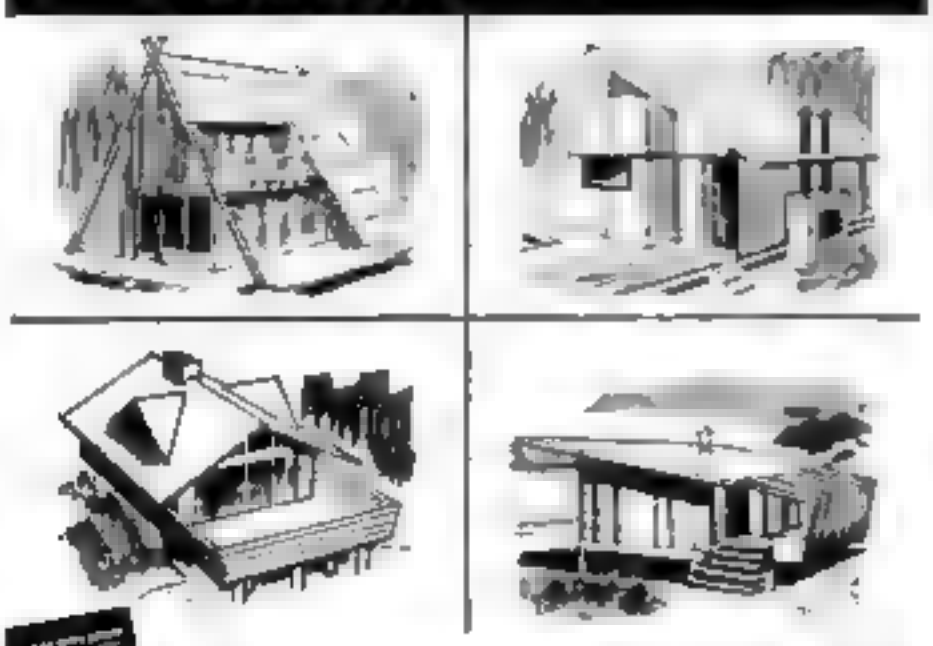

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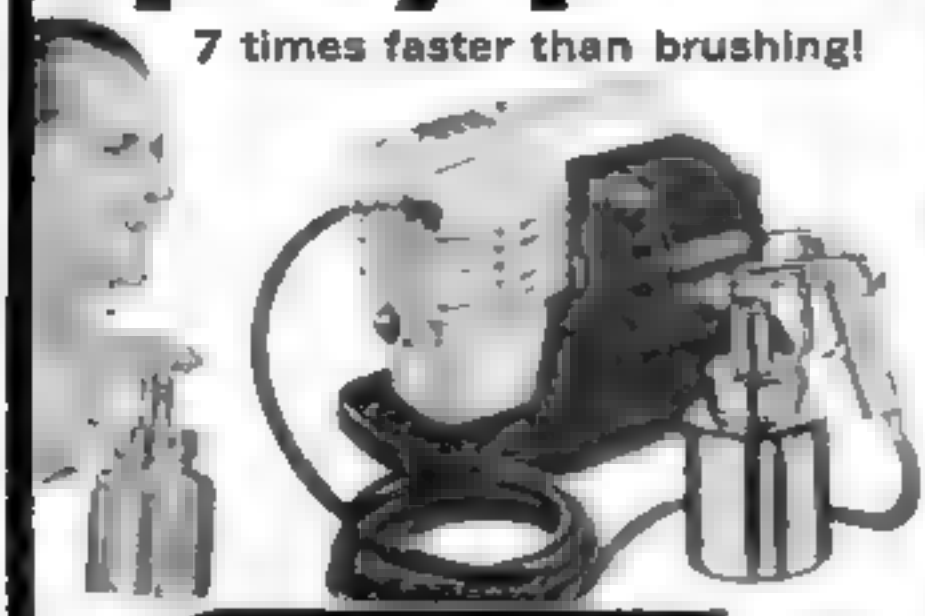

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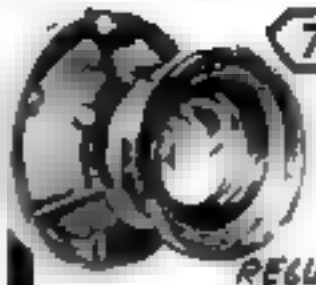

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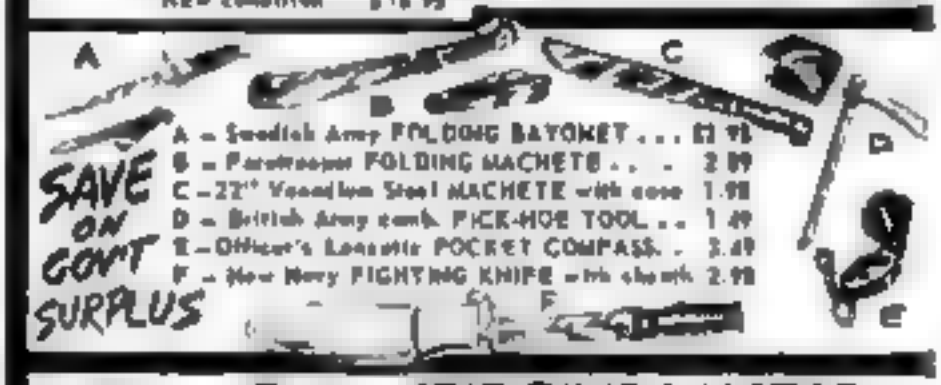

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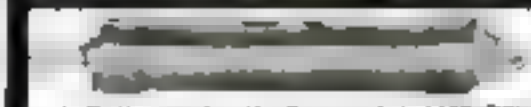

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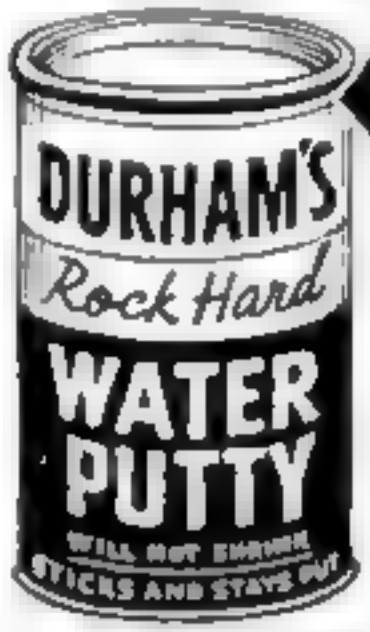

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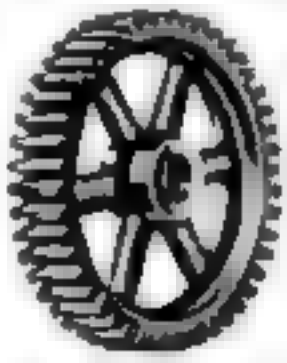

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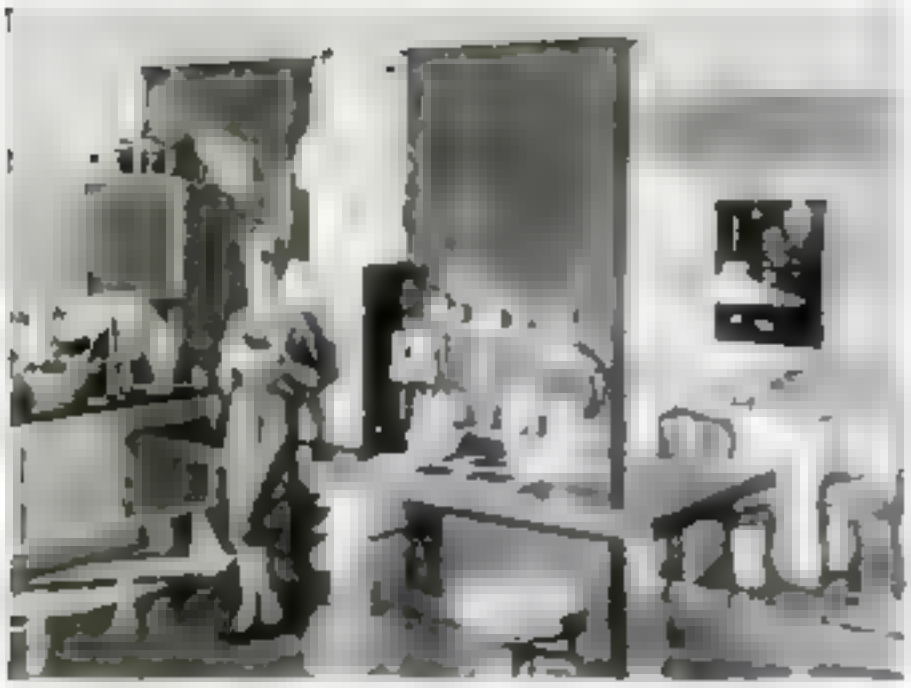

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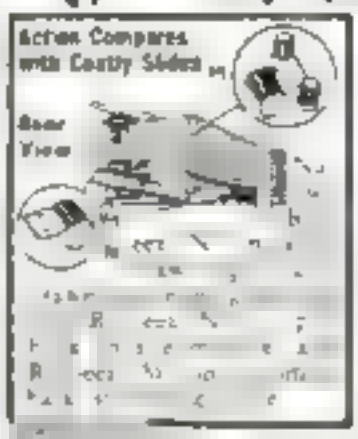

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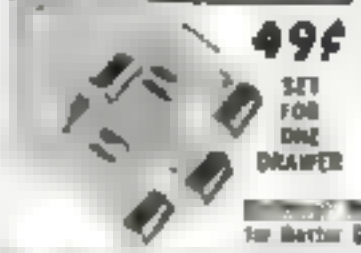

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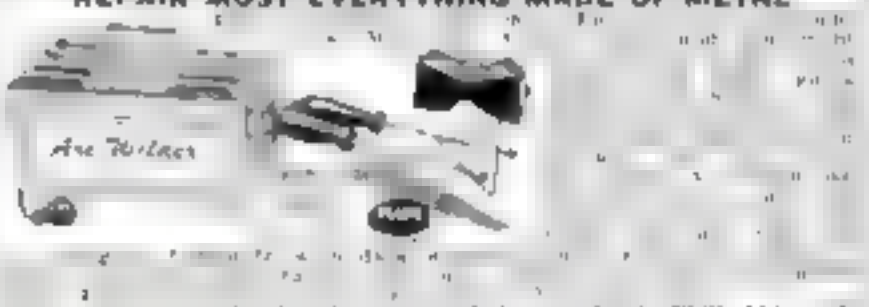

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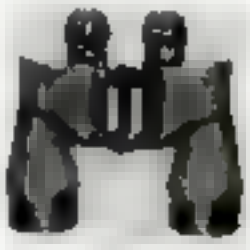

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[Continued from page 150]

and Acoustica) which expand and contract as they accumulate and release electrical charge. (The same crystals work in reverse in phonograph pickups.)

● The nickel-iron cores of electromagnets (Westinghouse) which expand and contract as they are magnetized and demagnetized.

Either way, the result is the same. An electrical vibration causes a mechanical vibration. The mechanical vibration is sound. It travels through the tank wall, into the water and through the water until it hits the dirty dishes.

Other sonic uses. This kind of short, fast and powerful vibration is the secret of the other tricks with sound.

For drilling, the sound goes to a bit that vibrates abrasive powder. The abrasive then cuts through anything—the harder the better. The hole it makes is the exact shape of the bit, so you can cut squares or any odd shape. The bit doesn't even have to be hard. (This leads to showy stunts: a fork cutting holes in glass, a penknife slicing tool steel.)

For soldering, a sonic bit shakes the oxide film off aluminum to expose bare metal for the solder to stick to. With more powerful sound, the molecules in two pieces of metal get jiggled so hard they fuse together into a weld.

Still more powerful sound—an audible and deafening scream generated by forcing compressed air through a special horn—makes dust particles in air clump together. (The particles get pushed back and forth so that they bump into each other.) These horns are used to eliminate smoke from factory stacks. And soon similar units will be lined up along an airport runway to clear fog away.

Since sound travels as a wave—somewhat the way light does—it can be focused into a beam, and the beam can be reflected. That's how depth finders, sub spotters and fish locators work. They send out pulses of sound and catch the reflections from the ocean bottom, a submarine or a school of fish. (It wasn't until after the physicists invented these machines that the biologists discovered that bats use the very same system—only better—to guide their flight.)

For probing people, too. Physicians are even using this idea to find flaws inside people. They get a picture (on a TV-like screen) that looks much the same as an X ray. Chief advantage: Soft organs, such as heart and lungs, show up better.

Doctors also use very powerful beams of very-high-frequency sound to treat many crippling afflictions. They're not sure why it works—it might heat the tissues inside the body, or simply jiggle them hard—but it often helps.

Breaking the cost barrier. Machines for these and many other jobs have been made by a number of companies (the industry did about $40,000,000 worth of business last year). But they are professional units at high prices—the hospital instrument cleaner sells for $3,000.

Westinghouse claims that its sound generator is both cheaper to produce and more effective. The nickel-iron core—the part that vibrates—is built like an automobile radiator, with thin, spaced plates. Narda and Acoustica also report development of less expensive, more efficient sound generators.

Presumably the new designs can be applied to home models of other sound machines. Hobbyists could use sound for soldering, welding or carving (present estimate of a machine for home soldering: $200). For housewives, there might be a sonic air cleaner to trap dust before it settled on the piano. And sportsmen would like an inexpensive fish locator.

What about washing clothes? This is still in the labs. The trouble: Clothes are soft and vibrate with the sound. The dirt sticks unless the sound is extremely powerful—and that's too expensive.

One way around the problem, suggests Irwin Steinberg, general manager of Vibro-Ceramics division of Gulton Industries, a leading maker of sound machines, is to use a very *low*-frequency sound (simplifying the power supply), and inject it into the water very close to the clothes (or dishes). That's as far as he will elaborate. "We're trying to sell the idea to manufacturers right now."

One new sound machine that even an outsider can forecast is a sonic bathtub. The vibrations cause a pleasant tickling sensation (you feel it when you stick your hand in the dishwasher). Now if they could rig it so that it also takes the dirt off small boys. . . END

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After examining me, the doctor explained that my condition was merely the result of a prolonged nutritional deficiency. He told me that a lack of vitamins and minerals was actually making me tired and cranky, and recommended a good nutritional supplement.

I started taking Vitasafe High-Potency Capsules, and Phil and I soon noticed the wonderful difference. My tiredness disappeared, I wasn't nervous anymore — and thank goodness I stopped nagging!

If you are suffering from vitamin-mineral deficiency, why not see if Vitasafe Capsules can help you? Simply mail the postcard for a trial 30-day supply!

A dramatization posed by professional model.

Our fights have turned to kisses!

A dramatization posed by professional models.

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